ENVIRONMENTAL ASSESSMENT

MANAGEMENT
OF
AQUATIC RODENT DAMAGE IN MISSOURI

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For

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LIST OF ACRONYMS

ADC	Animal Damage Control
APHIS	Animal and Plant Health Inspection Service
ARDM	Aquatic Rodent Damage Management
AVMA	American Veterinary Medical Association
CFR	Code of Federal Regulations
CWA	Clean Water Act
CY	Calendar Year
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FAA	Federal Aviation Agency
FDA	Food and Drug Administration
FEIS	Final Environmental Impact Statement
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FY	Fiscal Year
IPM	Integrated Pest Management
IWDM	Integrated Wildlife Damage Management
MASS	Missouri Agriculture Statistics Service
MDA	Missouri Depart of Agriculture
MDC	Missouri Department of Conservation
MDH	Missouri Department of Health
MDNR	Missouri Department of Natural Resources
MIS	Management Information System
MOU	Memorandum of Understanding
NASS	National Agriculture Statistics Service
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NRCS	Natural Resource Conservation Service
NWP	Nationwide Permit
NWRC	National Wildlife Research Center
OSHA	Occupational Safety and Health Administration
SOP	Standard Operating Procedure
TA	Technical Assistance
T&E	Threatened and Endangered
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USDI	U.S. Department of Interior
USGS	U.S. Geological Survey
USFWS	U.S. Fish and Wildlife Services
WS	Wildlife Services
ZP	Zinc Phosphide

CHAPTER 1: PURPOSE AND NEED FOR ACTION

1.1 INTRODUCTION

The United States Department of Agriculture (USDA) is authorized to protect American agriculture and other resources from damage associated with wildlife. The primary statutory authority for the USDA, Animal and Plant Health Inspection Service (APHIS), Wildlife Services (WS) program is the Act of March 2, 1931, as amended (7 U.S. C. 426-426b; c. 370 § 1, 46 Stat. 1468-69; Dec. 13 1991, Pub. L. 10237, Title X, § 1013(d), 105 Stat. 1901, and Oct. 28, 2000 Pub. L. 106-387, § 1(a) [Title VII], § 767], 114 Stat 1549) and the Rural Development, Agriculture, and Related Agencies Appropriations Act of 1988 (P.L. 100-202). WS activities are conducted in cooperation with other federal, state and local agencies; and private organizations and individuals. Federal agencies, including the United States Department of Interior (USDI), Fish and Wildlife Service (USFWS), recognize the expertise of WS to address wildlife damage issues related to aquatic rodents.

Wildlife damage management, is defined as the alleviation of damage or other problems caused by or related to the presence of wildlife. It is an integral component of wildlife management (The Wildlife Society 1992,). The WS program uses an Integrated Wildlife Damage Management (IWDM) approach (sometimes referred to as Integrated Pest Management or IPM) in which a combination of methods may be used or recommended to reduce wildlife damage. IWDM is described in Chapter 1, 1-7 of The Animal Damage Control (ADC) Program Final Environmental Impact Statement (USDA 1997 Revised). These methods include the alteration of cultural practices as well as habitat and behavioral modification to prevent damage. The control of wildlife damage may also require that the offending animal(s) be removed or that populations of the offending species are reduced through lethal methods.

WS mission is to "provide leadership in wildlife damage management in the protection of America's agricultural, industrial and natural resources, and to safeguard public health and safety." This is accomplished through:

A) Training of wildlife damage management professionals;
B) Development and improvement of strategies to reduce economic losses and threats to humans from wildlife;
C) Collection, evaluation, and dissemination of management information;
D) Cooperative wildlife damage management programs;
E) Informing and educating the public on how to reduce wildlife damage and;
F) Providing data and a source for limited-use management materials and equipment, including pesticides

This Environmental Assessment (EA) evaluates ways by which this responsibility can be carried out to resolve damage and conflicts associated with aquatic rodents in Missouri.

WS is a cooperatively funded and service oriented program. Before any operational wildlife damage management is conducted, WS and the landowner/manager must complete Agreements for Control or WS Work Plans. WS cooperates with private landowner/managers and with

appropriate land and wildlife management agencies, as requested, with the goal of effectively and efficiently resolving wildlife damage problems in compliance with all applicable federal, state, and local laws.

Individual actions on the types of sites encompassed by this analysis may be categorically excluded under the APHIS Implementing Regulations for compliance with the National Environmental Policy Act (NEPA) (7 CFR 372.5(c)). APHIS Implementing Regulations also provide that all technical assistance furnished by WS is categorically excluded (7 CFR 372.5(c)) (60 Federal Register 6,000, 6,003 (1995)). WS has decided to prepare this EA to assist in planning aquatic rodent damage management (ARDM) activities and to clearly communicate with the public the analysis of cumulative impacts for a number of issues of concern in relation to alternative means of reducing aquatic rodent damage in Missouri. This analysis covers WS plans for current and future ARDM actions wherever they might be requested in Missouri.

This EA documents the analysis of the potential environmental effects of the proposed program and alternatives for addressing problems with aquatic rodent damage. This analysis relies mainly on existing data contained in published documents, the Animal Damage Control Final Environmental Impact Statement (USDA 1997 Revised), and data from the WS Management Information System (MIS). All WS activities will be undertaken in compliance with relevant laws, regulations, policies, orders, and procedures including the Endangered Species Act.

1.2 PURPOSE

The purpose of this EA is to analyze the effects of alternatives for WS involvement in the management of damage by beaver (*Castor canadensis)*, muskrat (*Ondatra zibethica*), and nutria (*Myocastor coyous*) in Missouri. Resources protected by such activities include but are not limited to: property, crops, natural resources, and human health and safety. Some of the types of damage that resource owners seek to alleviate are: flooding of agricultural lands and roads, burrowing in levies and water control structures, road bed failures due to impounded water, damage to commercial timber and ornamental trees and shrubs from flooding and cutting, structural degradation of storm water ditches, loss of or damage to habitat for native wildlife and fish species, and hazards to aviation at airports.

1.3 SUMMARY OF PROPOSED ACTION

WS proposes to continue its current ARDM program for the State of Missouri. An IWDM approach, including technical assistance and operational damage management services, would be implemented to reduce beaver, muskrat, and nutria damage to property, roads, bridges, railroads, agricultural and natural resources and public health and safety. Damage management would be conducted on public and private property in Missouri where a need exists and when resource owners (property owners) or managers request WS assistance. The IWDM strategy would encompass the use of all practical and effective non-lethal and lethal methods of preventing or reducing damage while minimizing harmful effects of damage management methods on humans, target and non-target species, and the environment. WS would provide technical assistance and operational damage management, including non-lethal and lethal management methods by applying the WS Decision Model (Slate et al. 1992). When appropriate, physical exclusion or

habitat modification could be recommended and utilized to reduce aquatic rodent damage. Aquatic rodents captured in non-lethal devices (leg-hold traps, snares, cage traps, colony traps, etc.) would subsequently be euthanized. In other situations problem animals would be removed as humanely as possible using lethal methods including body gripping traps (e.g., Conibear-type), snares, zinc phosphide bait for muskrats and nutria, leg-hold traps and shooting. When appropriate, beaver dams could be removed by using binary explosives or by hand. Preference would be given to practical and effective non-lethal methods, but non-lethal method may not always be applied as a first response to each damage problem. The most appropriate response could be a combination of non-lethal and lethal methods, or there could be instance where application of lethal methods alone would be the most appropriate strategy. Aquatic rodent damage management would be conducted in the State when requested on private or public property after an *Agreement for Control* or other comparable document has been completed and funding has been secured. All aquatic rodent damage management would be consistent with other uses of the area and would comply with appropriate federal, State and local laws.

1.3.1 Goal of the Wildlife Services Aquatic Rodent Damage Management Program in Missouri

The MO WS program has the goal of minimizing aquatic rodent damage or the risk of damage to agriculture, aquaculture, other fish and wildlife species, property, human health and safety, and other resources throughout the state.

1.4 SPECIES ECOLOGY - BEAVER, NUTRIA, AND MUSKRAT

1.4.1 Beaver Ecology

Beaver are the largest rodent in North America. Adult beaver weigh, on average, from 35-50 pounds, with individuals attaining weights up to 100 lbs. The beaver is physically adapted for life in an aquatic environment with webbed rear feet, a flat paddle-like tail, valvular nose and ears, lips that close behind the four large incisor teeth and dense waterproof fur (Miller and Yarrow 1994).

Beaver are found throughout North America, except for the artic tundra, most of peninsular Florida and southwestern desert areas. The species may be locally abundant wherever suitable habitat is found (Miller and Yarrow 1994). Beaver have only a few natural predators aside from humans, including coyotes, bobcats, river otter, bears, and mink who prey on the young (Miller and Yarrow 1994). In some areas, mountain lions, wolves, and wolverines also may prey on beaver.

Beaver habitat is almost anywhere there is a year-round source of water and an adequate food source. With the exception of man, beaver have changed the face of the land more than any other animal. Beaver modify their habitat by building dams to impound water to provided protection from predators and access to food sources. Dams are usually built with mud and sticks, but rocks, corn stalks and other available materials are also occasionally used (Miller and Yarrow 1994). Depending upon site conditions, beaver may not always build dams. Beaver reside in lodges that are constructed of mud and sticks, or in bank dens for warmth,

security and raising young (Miller and Yarrow 1994). Entrances for these structures are located underwater for security purposes. Entrances may be from a few inches to several feet below the surface. Beaver usually have at least two to three entrances to their lodges or bank dens (McNeely 1995)

Beaver are strict herbivores and feed on a variety of trees, herbaceous and aquatic vegetation. In Missouri, tree species preferred by beaver are willow (*Salix sp.*), Eastern cottonwood (*Populus deltoids*), and river birch (*Betula nigra*).

Beaver usually have one litter a year of approximately 3-4 kittens which are born fully-furred. Young beaver often remain in the colony with the adults and aid in territory defense and dam and den construction until sexually mature (approximately 2 years old (Miller and Yarrow 1994)

1.4.2 Benefits of Beaver

Once considered an animal near extinction (Hill 1976, Wesley 1978) strict limits on beaver hunting/trapping and habitat improvements have resulted in increasing beaver populations. Beaver are now viewed as a pest species in many southeastern states (Hill 1976, 1982). Although beaver may cause extensive damage and are considered a pest by some, many benefits are associated with their daily activities. Beaver impoundments can provide aesthetic and recreational opportunities for wildlife observation (Wade and Ramsey 1986). Positive ecological influences from the creation of wetland habitats (Arner et al. 1967a, b, Reese and Hair 1976) and economic gains from fur production (Hill 1976, Arner and Dubose 1978a, b) also make beaver important animals.

Some of the benefits of beaver ponds include activities such as trapping, hunting, and fishing, and aesthetic benefits including photography. Beaver ponds and associated wetlands can provide a potential water source for livestock, contribute to the stabilization of water tables, help reduce rapid run-off from rain (Wade and Ramsey 1986), serve as basins for the entrapment of streambed silt and eroding soil (Hill 1982), and help to filter nutrients from the water thereby maintaining the quality of nearby water systems (Arner and Hepp 1989).

Beaver may increase habitat diversity by opening forest habitats via dam building and tree cutting which results in a greater mix of plant species, and different-aged plant communities (Hill 1982, Arner and Hepp 1989). Creation of standing water, edge habitat, and plant diversity, all in close proximity, results in excellent habitat for many wildlife species (Jenkins and Busher 1979, Arner and DuBose 1982, Hill 1982, Arner and Hepp 1989, Medin and Clary 1990, Medin and Clary 1991). The wetland habitat associated with beaver ponds is beneficial to some fish (warm water species), reptiles, amphibians, waterfowl, shorebirds, and furbearers such as muskrats, otter, and mink (Arner and DuBose 1982, Naimen et al. 1986, Miller and Yarrow 1994). In Mississippi, beaver ponds over three years in age were found to have developed plant communities valuable as nesting and brood rearing habitat for wood ducks (Arner and DuBose 1982). Reese and Hair (1976) found that beaver pond habitats were highly attractive to a large number of birds year-round and that the value of beaver pond habitat to waterfowl was minor when compared to other species of birds (Novak

1987a). Beaver ponds may also be beneficial to some threatened and endangered (T&E) species. The United States Fish and Wildlife Service (USFWS) estimates that up to 43% of T&E species rely directly or indirectly on wetlands for their survival (Environmental Protection Agency (EPA) 1995).

1.4.3 Muskrat Ecology

Muskrats are a native North American aquatic rodent. Like beaver, muskrats live in aquatic habitats and are well adapted for swimming. Large hind feet of muskrats are partially webbed with stiff hairs aligning the toes. Tails are laterally flattened and almost as long as body length. Muskrats have a stocky appearance, with small eyes and very short, rounded ears. Front feet, which are much smaller than hind feet, are adapted primarily for digging and feeding. Adult muskrats are usually 22 to 25 inches long and weigh approximately 2.5 pounds (McNeely 1998).

Muskrats are most abundant in the southeast of Missouri, but can be found scattered in suitable habitat throughout the state inhabiting creeks, rivers, lakes, ponds, and drainage ditches. Muskrats prefer areas with a steady water level and feed primarily on cattails (*Typha* sp.), bulrushes (*Scirpus* sp.), and aquatic grasses. Muskrats commonly dig bank dens. In areas with plentiful vegetation, muskrats may build conical shaped houses and/or additions to bank dens. Muskrats may also build smaller feeding houses or platforms (Miller 1994). Unlike beaver, muskrats do not build dams.

Muskrats breed from early spring until fall, and may produce multiple litters a year depending upon the region of the country. Each litter contains from four to seven young, which are born hairless. Young muskrats grow rapidly and are independent when one month old (McNeely 1998). Age of sexual maturity varies between males and females. Males are generally sexually mature at 12 months. Females in the South may be sexually mature at 4-5 months while females in northern areas may require 12 months to reach sexual maturity (Erb and Perry 2003).

1.4.4 Benefits of Muskrats

Historically, muskrats have been the most heavily utilized furbearer in North America with 6-20 million harvested annually since about 1935 (Boutin and Birkenholz 1987). Muskrats not only have economic value from the sale of their meat and pelt, but they are an indigenous species to North America that fill an important niche in the ecosystem. In the prairie pothole region of the U.S. and Canada, muskrats clear or open small areas through feeding and house building in otherwise dense cattail marshes. The small openings in the cattail marshes are valuable nesting and brood rearing habitat for waterfowl. Muskrats also provide opportunities for recreation and satisfaction to people that like to observe wildlife in a natural setting.

1.4.5 Nutria Ecology

Nutria are large, dark colored, semi-aquatic rodents native to South America. Nutria have short legs and robust, highly arched bodies that are approximately 24 inches in length at maturity. Forepaws have four well developed, clawed toes and one vestigial toe. Four of the five clawed toes on the hind feet are interconnected by webbing; the fifth outer toe is free. Hind legs of nutria are much larger than forelegs. Nutria tails are round, range from 13 to 16 sixteen inches in length, and are scantily haired. Male nutria are slightly larger than female nutria with an average weight for either sex about 12 pounds. Male and female nutria may grow to 20 and 18 pounds, respectively.

Nutria became established in the United States after releases in the 1930's and 1940's. A 1999 survey of 22 states where nutria had been intentionally introduced and 11 adjacent states reported nutria in 15 states (Washington, Oregon, New Mexico, Texas, Oklahoma, Arkansas, Louisiana, Tennessee, Mississippi, Alabama, Georgia, Florida, North Carolina, Virginia, Maryland and Delaware) and were subsequently reported in New Mexico in 2002 (Bounds 2000, Bounds et al. 2003). Nutria have been reported in other areas of the U.S. including some Great Lakes States. Nutria are also currently found in the boot heel region of Missouri.

Nutria primarily inhabit brackish or freshwater marshes, but are can be found in swamps, rivers, ponds, and lakes. Dense vegetation, abandoned burrows, and burrows dug along steam banks or shorelines are preferred den sites for nutria (Wade and Ramsey 1986). Nutria dig burrows in grassy natural or human-made banks of waterways but may live in dense vegetation in the summer. Nutria are almost entirely herbivorous and eat animal material (mostly insects) incidentally. Freshwater mussels and crustaceans are occasionally eaten in some parts of their range (LeBlanc 1994)

In much of their range, nutria breed in all seasons. Sexually active individuals may be present every month of the year. Litters generally average 4-5 young but can range from 1-13. Young are born fully-furred and reach sexual maturity at approximately 4 months of age. (LeBlanc 1994). The high reproductive capacity of this species is one of the reasons it is a threat to native ecosystems.

1.4.6 Benefits of Nutria

Nutria were introduced to the U.S. in the hopes of establishing them as a fur resource and, in some places, nutria were released to control aquatic weeds (Wade and Ramsey 1986). The promotion of nutria for fur ranching and weed control was a failure. However, nutria may provide a means of income for some hunters and trappers through the sale of nutria meat and fur. From 1977 to 1984 approximately $7.3 million worth of nutria fur was harvested in the United States (Boutin and Birkenholz 1987). As an introduced species, nutria do not have beneficial impacts on aquatic ecosystems in the U.S.

1.5 SOCIETY ATTITUDES TOWARDS AQUATIC RODENT DAMAGE

Opinions and attitudes of individuals, communities, and organizations regarding aquatic rodent damage vary greatly and are primarily influenced and formed by benefits and damage directly experienced by each person or entity (Hill 1982). Property ownership, options for public and private land use, and effects on adjacent property impact individual attitudes toward beaver (Hill 1982). Beaver activities result in "damage" when adverse impacts are perceived as outweighing benefits (Wade and Ramsey 1986, Miller and Yarrow 1994). Woodward et al. (1976) found that 24% of landowners who reported beaver activity on their property also indicated benefits to having beaver ponds on their land. However, surveys in North Carolina and Alabama indicate the majority of landowners with beaver damage on their property desire damage management via beaver removal (Hill 1976, Lewis 1979, Woodward et al. 1985). Loker et al. (1999) found that some suburban residents also may desire lethal management methods to resolve beaver damage conflicts. See also Section 2.2.7..

1.6 NEED FOR ACTION

1.6.1 Damage from Beaver Activities

Over harvest and habitat alterations resulted in the elimination of beaver from Missouri by 1915. Reintroduction efforts started in 1928-29. The MDC conducted a trap and transplant program from 1939-1955. Reintroduction efforts were extremely successful (Vance 1998). As with many other areas in North America, expansion of the Missouri has resulted in conflicts between beaver and humans (Novak 1987a).

Identifying beaver damage is generally not difficult. Most of the damage caused by beaver is a result of dam building, bank burrowing, tree cutting and girdling, obstructing overflow structures and spillways, and flooding. Some cases of beaver damage include flooded state highways, reservoir dams destroyed or weakened by bank dens and burrows, and train derailments due to track damage resulting from continued flooding and burrowing (Miller and Yarrow 1994). Housing developments also have been threatened by flooding and small bridges have been destroyed because of beaver dam construction. Miller (1983) estimated the annual damage in the United States was $75-$100 million. Economic damage was estimated to have exceeded $4 billion in the southeastern United States over a 40-year period (Arner and Dubose 1979). In some southeastern States, losses from beaver damage have been estimated from $3 to 5 million annually (Miller and Yarrow 1994), with timber losses being reported as the most common type of damage (Hill 1982). Tracts of bottomland hardwood timber up to several thousand acres in size may be lost due to beaver activity (Miller and Yarrow 1994).

Increased water levels in urban areas resulting from beaver activity can lead to unsanitary conditions and potential health problems by flooding septic systems and sewage treatment facilities (DeAlmeida 1987, Loeb 1994). Beaver ponds provide conditions favorable to mosquitoes and can hinder mosquito control efforts or result in increases in insect populations (Wade and Ramsey 1986). While the presence of these insects is

largely a nuisance, mosquitoes can transmit diseases, such as encephalitis (Mallis 1982) and West Niles virus. Beaver are carriers of the intestinal parasite *Giardia lamblia* and beaver feces can contaminate human water supplies and cause outbreaks of the disease Giardiasis in humans (Woodward 1983, Beach and McCulloch 1985, Wade and Ramsey 1986). The Centers for Disease Control have recorded at least 41 outbreaks of waterborne Giardiasis affecting more than 15,000 people. Beaver also are known carriers of tularemia, a bacterial disease that is transmittable to humans through bites by insects or infected animals or by handling animals or carcasses which are infected (Wade and Ramsey 1986). Skinner et al. (1984) found that in cattle-ranching sections of Wyoming, the fecal bacterial count was much higher in beaver ponds than in other ponds, something that can be a concern to ranchers and recreationalists. On rare occasions, beaver may contract the rabies virus and attack humans. In February 1999, a beaver attacked and wounded a dog and chased children that were playing near a stream in Vienna, Virginia. Approximately a week later, a beaver was found dead at the site and tested positive for rabies. Damming of streams sometimes increases the number of aquatic snakes, including the poisonous cottonmouth (*Agkistrodon piscivorus*) (Wade and Ramsey 1986).

While beaver ponds can be beneficial to some species of wildlife, beaver activities can also destroy critical habitat types (e.g. free-flowing water, riparian areas, and bird roosting and nesting areas) which are important to other wildlife species including certain species of fish and mussels which may be dependent upon clear, cool and/or fast moving water. Beaver dams may increase sedimentation in streams thereby negatively affecting species that depend on clear water and gravel stream bottoms. For example, the Louisiana WS program has conducted beaver damage management activities to protect the Louisiana pearlshell (*Margaritifera hembeli*), which requires clear, free-flowing water to survive (D. LeBlanc, USDA/APHIS/WS, personal communication). Beaver impacts on trout habitat have been a major concern of the Wisconsin Department of Natural Resources and the general public since as early as 1950. Patterson (1951) found beaver impoundments in the Peshtigo River Watershed caused significant negative impacts to trout habitat by raising water temperatures, destroying immediate bank cover, changing water and soil conditions, and causing silt accumulations in spawning areas. Studies from other areas also document negative impacts of beaver impoundments on trout habitat (Sayler 1935, Cook 1940, Sprules 1940, Bailey and Stevens 1951). The Wisconsin Department of Natural Resources guidelines for management of trout stream habitat stated that beaver dams are a major source of damage to trout streams (White and Brynildson 1967, Churchill 1980). More recent studies have documented improvements to trout habitat upon removal of beaver dams. Avery (1992) found wild brook trout populations in tributaries to the north branch of the Pemebonwon River in northeastern Wisconsin improved significantly following the removal of beaver dams. Species abundance, species distribution, and total biomass of non-salmonids also increased following the removal of beaver dams (Avery 1992). Increased soil moisture both within and surrounding beaver flooded areas can result in reduced timber growth and mast production and increased bank destabilization. While beneficial in some areas, these habitat modifications can conflict with human land or resource management objectives and can be problems for some plants and animals, including T&E species.

Beaver often inhabit sites in or adjacent to urban/suburban areas and cut or girdle trees and shrubs in yards, undermine yards and walkways by burrowing, flood homes and other structures, destroy pond and reservoir dams by burrowing into levees, gnaw on boat houses and docks, and cause other damage to private and public property (Wade and Ramsey 1986). Additionally, roads and railroads beds may be damaged by saturation from beaver flooding or by beaver burrowing. Consequently, roadbed and railroad bed safety and integrity are compromised.

Beaver also cause an assortment of other damage such as: flooding of croplands, pastures, and timberlands, feeding on crops such as corn, soybeans, sorghum, etc., and interfering with irrigation systems and water level control structures (Hill 1982, Woodward 1983, Wade and Ramsey 1986, Miller and Yarrow 1994). Beaver have been documented damaging fiber optic cables by gnawing (Unpub. data, South Carolina WS)

WS beaver damage management efforts in Missouri are primarily conducted for the purpose of minimizing damage to roadways (State and County), urban and suburban properties, agricultural and timber resources, and irrigation infrastructures (Table 1.1). In some cases, efforts are aimed at protecting wildlife habitat which is degraded due to beaver related flooding and dam building. WS personnel use a variety of methods for reducing beaver damage which allows for greater flexibility and increased opportunity to formulate an effective strategy best suited to each request (see Appendix D).

Table 1.1 Cost of beaver damage in Missouri (confirmed by WS and reported by cooperators) by damage type for Calendar Years 2002 and 2003. This data is only for WS cooperators and does not include loss estimates from landowner/managers who handle beaver problems on their own.

	Agriculture	Property	Irrigation	Roads	Timber
Calendar Year 2002	$227,342	$10,100	$79,050	$10,000	$5,000
Calendar Year 2003	$199,206	$4,500	$42,490	$200	$200
Total	$426,548	$14,600	$121,540	$10,200	$5,200

1.6.2 Damage from Muskrat Activities

Economic loss due to muskrat damage can be very high, particularly in rice and aquaculture production areas where muskrats cause extensive damage to levees. In some states damage may be as much as $1 million per year (Miller 1994). Elsewhere, economic losses caused by muskrats may be limited and confined primarily to burrowing in farm pond dams or feeding on desirable plants.

Most of the damage caused by muskrats is due to burrowing in dikes, dams, ditches, ponds, and shorelines (Perry 1982, Miller 1994, Linzey 1998) Muskrats dig burrows with underwater entrances along the shoreline which may not be readily evident until serious damage has occurred. When the water level drops, muskrat holes are often expanded to

keep pace with the retreating water level. Additionally, when water levels rise muskrats expand the burrows upward. Muskrat burrows can collapse when walked upon by people or animals or crossed over with heavy equipment (i.e. mowers, tractors). Muskrat burrowing activity can seriously weaken man-made dams and levees (Perry 1982). Leaks and failure of water control structures can result in water damage in the areas neighboring the man-made dam or levee and can cause loss of crops due to lack of water in areas where water should be retained (Wade and Ramsey 1986). Restoring recreational fisheries and rebuilding damaged dams and levees can be extremely costly. Muskrat burrowing in waterfront lawns and yards creates cave-ins and shoreline degradation. Muskrat damage often can be more difficult to detect on farm ponds with heavy vegetation than on aquaculture ponds. Aquaculture reservoirs often lack aquatic vegetation which makes muskrat runs and burrows, remains of mussels, crawfish, and fish from muskrat feeding, and other muskrat sign easier to observe.

Although muskrats are mainly herbivorous, other animals often comprise part of their diet (Perry 1982). Schwartz and Schwartz (1959), Neves and Odom (1989), and Miller (1994) reported muskrat diets consisting of mussels, clams, snails, crustaceans (i.e., crawfish), and young birds. In some aquaculture industry areas, this feeding habit may cause economic loss (Miller 1994)

Muskrats eat a variety of natural emergent vegetation (Linzey 1998) and cultivated crops (Perry 1982). Some of the cultivated crops eaten by muskrats include corn, alfalfa, carrots, rice, and soybeans. When muskrats become over-populated, generally an "eat-out" occurs and the feeding area is ruined for a number of years (O'Neil 1949). An "eat-out" occurs when vegetation and soil binding roots are consumed which results in loss of vegetation, food, and cover for muskrats and other wildlife. Marsh damage from muskrats is inevitable when areas heavily populated by muskrats are under-trapped (Lynch et al. 1947). "Eat-outs" are beneficial to some fish eating bird species because they reduce cover for prey creating easier access to food sources. "Eat-outs" are also beneficial by increasing the amount of loafing areas for shorebirds and some species of ducks; however, "eat-outs" also result in stagnate water which predisposes the same birds to diseases(Lynch et al. 1947) like West Nile Virus, St. Louis encephalitis, LaCrosse encephalitis, and Western Equine encephalitis.

WS muskrat damage management efforts in Missouri are primarily conducted for the purposes of minimizing damage to urban and suburban properties, agricultural and timber resources, and irrigation resources. (Table 1.2)

Table 1.2 Cost of muskrat damage in Missouri (confirmed by WS and reported by cooperators) by damage type for Calendar Years 2002 and 2003 This data is only for WS cooperators and does not include loss estimates from landowner/managers who handle muskrat problems on their own.

	Property	Irrigation
Calendar Year 2000	$0	$20,000
Calendar Year 2001	$100,000	$25,000
Calendar Year 2002	$38,000	$0
Calendar Year 2003	25,000	$200
Total	**$163,000**	**$45,200**

1.6.3 Damage from Nutria Activities

Nutria feed on valuable wetland vegetation and cultivated crops such as sugar cane and rice (Wade and Ramsey 1986). The bark of trees such as black willow (*Salix nigra*) and bald cypress (*Taxodium distichum*) may be eaten in winter months when more preferred herbaceous vegetation is dormant. Nutria also cause damage by eating lawn grasses found adjacent to aquatic habitats. Nutria are opportunistic feeders and eat approximately 25% of their body weight daily (LeBlanc 1994). Nutria are an introduced species and often compete for food and space with native furbearers.

Burrowing is the most common type of damage caused by nutria. Nutria undermine and dig through water-retaining levees in flooded fields used to produce rice, fish, and crawfish in Louisiana, Mississippi, and Texas. Additionally, burrowing activity can weaken flood control levees used to protect low-lying urban areas. In some cases, tunneling in levees is so extensive water will flow unobstructed through the levee, necessitating the complete reconstruction of a section of levee. Nutria burrows can weaken road beds, stream banks, dams, and dikes. These resources can collapse when the soil is saturated by rain or high water, or when heavy objects travel above the burrows (e.g., vehicles, farm machinery, or grazing livestock). Rain and wave action can wash out and enlarge collapsed burrows and compound damage. Nutria often burrow into styrofoam used for floatation under boat docks, wharves, and houseboats. These burrows can cause structures to become unstable due to unequal buoyancy and possibly sink. Nutria have been known to burrow under buildings and structures which can lead to uneven settling and foundation failure.

Nutria depredation on crops is well documented (LeBlanc 1994). In the United States, sugarcane and rice are the primary crops damaged by nutria. Grazing on rice plants can dramatically reduce yields, and damage can be locally severe. Sugarcane stalks are often gnawed or cut during the growing season, and often only the basal internodes (section between the ground and first leaf) of cut plants are eaten. Other crops that have been damaged by nutria feeding include corn, milo (grain sorghum), sugar and table beets, alfalfa, wheat, barely, oats, peanuts, various melons, and a variety of vegetables from home

gardens and truck farms. Fruit, nut, and shade trees and ornamental shrubs are often girdled by nutria. Nutria also damage lawns and golf courses when digging and feeding on the tender roots and shoots of sod grasses. Gnawing damage to wooden structures is common. Nutria also gnaw on styrofoam floats used to mark the location of traps in commercial crawfish ponds.

At high densities and under certain environmental conditions, nutria foraging can substantially impact natural plant communities. In Louisiana, nutria often feed on bald cypress (*Taxodium distichum)* seedlings and can cause complete failure of planted and naturally regenerated stands. Over-utilization of emergent marsh plants can damage stands of desirable vegetation used by other wildlife species. Over utilization also can aggravate coastal erosion problems by destroying vegetation that stabilizes marsh soils. Nutria prefer grassy arrowhead (*Sagittaria platyphylla*) tubers and may destroy stands propagated as food for waterfowl in artificial impoundments.

Nutria can be infected with several pathogens and parasites that can be transmitted to humans, livestock, and pets (LeBlanc1994). However, the role of nutria in the spread of diseases such as equine encephalomyelitis, leptospirosis, hemorrhagic septicemia (pasteurellosis), paratyphoid, and salmonellosis is not well documented. Nutria also may host a number of parasites, including the nematodes and blood flukes that cause "swimmers itch" or "nutria itch" (*Strongyloides myopotami* and *Schistosoma mansoni*, respectively), the protozoan responsible for Giardiasis, tapeworms (*Taenia sp.*), and common flukes (*Fasciola hepatica*). The threat of disease may be an important consideration in some situations, such as when livestock drink from water contaminated by nutria feces and urine.

Although WS has not received any requests to provide assistance with nutria, biologists with WS and the Missouri Department of Conservation are reporting an increase in reports of nutria sightings and nutria activity, and are concerned that nutria numbers in Missouri may be increasing. Management of conflicts associated with nutria is being addressed in this EA so that WS may immediately assist MDC in minimizing the impacts of this non-native species on people and ecosystems in Missouri.

1.7 NEED FOR ARDM IN MISSOURI

The need for action in Missouri is based on aquatic rodent damage to: 1) agricultural and natural resources, 2) property, 3) roads, bridges, and railroads, and risks to 4) public health and safety (Table 1.3). Beaver, nutria, and muskrat populations can have a negative economic impact throughout the state. State agencies in Missouri provide little to no direct assistance to landowners with beaver, nutria, and muskrat damage management due to time and funding constraints and a lack of expertise. Similarly, private trappers generally prove inadequate for reducing beaver damage due to the high costs to landowners, low number of licensed trappers, and lack of expertise in damage management.

Conflicts between humans and wildlife are common throughout Missouri. Comprehensive surveys of beaver, nutria, and muskrat damage in Missouri have not been conducted to date. However, Missouri WS has compiled verified damage estimates and reported damage estimates

caused by aquatic rodents. Damage estimates are reported as economic loss ($) perceived by property and resource owners or managers who requested WS assistance. Damage data obtained from Management Information System (MIS) from calendar year (CY) 2000 through 2003 are summarized below. These data represent only a portion of the total damage caused by beaver, nutria, and muskrats because not all people who experience such damage request assistance from WS (Loven 1985).

- The total value of crop damage by aquatic rodents reported to WS in Missouri for four-year period of CY 2000-2003 was more than $536,000, with an annual average of $134,000+ to Missouri crops, hayfields and pastures (WS MIS Database).

- The total value of property damage by aquatic rodents reported to WS in Missouri for the four-year period of CY 2000-2003 was more than $360,000, with the annual average being S90,185. This included property damage reported for residential buildings and general property (WS MIS Database).

Table 1.3 – Requests for Technical Assistance and Direct Control projects worked by MO WS for Fiscal Years 2000-2003

Resource Type	**FY 00 Technical Assistance**		**FY 01 Technical Assistance**		**FY 02 Technical Assistance**		**FY 03 Technical Assistance**	
	Beaver	Muskrat	Beaver	Muskrat	Beaver	Muskrat	Beaver	Muskrat
Property, Residences, Landscaping					2			
Dikes & Impoundments		1				1	1	1
Irrigation Ditches					6			
Roads and Bridges					2			
Golf Course				1				
Crops			4		5		1	
Wetland					1			
Trees					3		1	
*Unspecified					5			
Total TA	0	1	4	1	24	1	3	1
	Direct Control Projects		**Direct Control Projects**		**Direct Control Projects**		**Direct Control Projects**	
Property, Residences, Landscaping			1				3	
Recreational Area					1			
Dikes & Impoundments		1		1	5	3	2	2
Irrigation					10		11	

Ditches								
Watersheds					4			
Roads and Bridges					2			
Golf Course				1				1
Crops			12		36		26	
Pastures & Hayfield					3		1	
Wetland	1				1			
Trees					4			
Total	1	1	13	2	66	3	43	3

* Denotes a technical assistance project where damage reduction was discussed in general and not for a specific resource type.

1.8 EXAMPLES OF CURRENT & PAST WS ARDM PROJECTS IN MISSOURI

- Beaver management in the Bootheel region of MO to protect agricultural crops
- Beaver management in the Bootheel region of MO to protect human health and safety from flooded roads.
- Beaver management in the Bootheel region of MO to protect property.
- Muskrat management to protect water control structures.
- Beaver management to protect human health and safety for disease outbreaks
- Beaver management to protect airports from flooding

1.9 RELATIONSHIP OF THIS ENVIRONMENTAL ASSESSMENT TO OTHER DOCUMENTS

ADC Programmatic FEIS

WS issued a Final Environmental Impact Statement on the national APHIS/WS program (USDA 1997 Revised). Pertinent information available in the FEIS has been incorporated by reference into this EA.

1.10 DECISION TO BE MADE

Based on the scope of this EA, the decisions to be made are:

- Should ARDM as currently implemented by the WS program be continued in Missouri?
- If not, how can WS best respond to the need to reduce aquatic rodent damage in Missouri?
- What are the potential impacts of the alternatives for addressing aquatic rodent damage?
- Does the proposal have significant impacts meriting an Environmental Impact Statement (EIS)?

1.11 SCOPE OF THE ENVIRONMENTAL ANALYSIS

1.11.1 Actions Analyzed This EA evaluates aquatic rodent damage management by WS to protect property, agriculture, natural resources, and human health and safety throughout Missouri wherever such management is requested from the WS program.

1.11.2 Period for Which this EA is Valid If it is determined that an EIS is not required, this EA will remain valid until WS determines that new needs for action, new alternatives having different environmental effects, or changes in environmental conditions must be analyzed. At that time, this analysis will be revised as necessary. This EA will be reviewed each year to determine if the impacts of WS ARDM activities are consistent with the impacts presented in this analysis.

1.11.3 American Indian Lands and Tribes Currently WS does not have any MOUs or signed agreements with any American Indian tribe in Missouri. If WS enters into an agreement with a tribe, this EA would be reviewed and supplemented if appropriate to insure compliance with NEPA.

1.11.4 Site Specificity This EA analyzes the potential impacts of WS' ARDM activities on all lands in Missouri where WS is currently or has been requested to provide assistance. It also addresses the impacts of ARDM activities on areas where WS may work in the future. This EA anticipates the potential expansion of WS activities and analyzes the impacts of such efforts.

Planning for ARDM must be viewed as being conceptually similar to Federal or other agency actions whose missions are to stop or prevent adverse consequences from anticipated future events for which the actual sites and locations where they will occur are unknown but could be anywhere in a defined geographic area. Examples of such agencies and programs include fire and police departments, emergency clean-up organizations, insurance companies, etc. Although some of the sites where ARDM will occur can be predicted, all specific locations or times where such damage will occur in any given year cannot be predicted. This EA emphasizes major issues as they relate to specific areas whenever possible, however, many issues apply wherever aquatic rodent damage and resulting management occurs, and are treated as such. The standard WS Decision Model (Slate et al. 1992) would be the site-specific procedure for individual actions conducted by WS in Missouri (*see* Chapter 3 for a description of the Decision Model and its application).

The analyses in this EA are intended to apply to any action that may occur *in any locale* and at *any time* within the analysis area. In this way, APHIS-WS believes it meets the intent of NEPA with regard to site-specific analysis and that this is the only practical way for WS to comply with NEPA and still be able to accomplish its mission.

1.11.5 Public Involvement/Notification. As part of this process, and as required by the Council on Environmental Quality (CEQ) and APHIS-NEPA implementing regulations, this document and the associated Decision are being made available to the public through "Notices of Availability" (NOA) published in local media and through direct mailings of NOA to parties that have specifically requested to be notified. All comments received

during the public review period for this EA will be fully considered and, where appropriate, incorporated into the analysis and final Decision.

1.12 AUTHORITY AND COMPLIANCE

1.12.1 Authority of Federal and State Agencies in Wildlife Damage Management within the State of Missouri

1.12.1.1 WS Legislative Authority

The primary statutory authority for the Wildlife Services program is the Act of 1931, as amended in the Fiscal Year 2001 Agriculture Appropriations Bill, which provides that:

> *"The Secretary of Agriculture may conduct a program of wildlife services with respect to injurious animal species and take any action the Secretary considers necessary in conducting the program. The Secretary shall administer the program in a manner consistent with all of the wildlife services authorities in effect on the day before the date of the enactment of the Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2001."*

Since 1931, with the changes in societal values, WS policies and programs place greater emphasis on the part of the Act discussing "bringing (damage) under control," rather than "eradication" and "suppression" of wildlife populations. In 1988, Congress strengthened the legislative mandate of WS with the Rural Development, Agriculture, and Related Agencies Appropriations Act. This Act states, in part:

> *"That hereafter, the Secretary of Agriculture is authorized, except for urban rodent control, to conduct activities and to enter into agreements with States, local jurisdictions, individuals, and public and private agencies, organizations, and institutions in the control of nuisance mammals and birds and those mammal and bird species that are reservoirs for zoonotic diseases, and to deposit any money collected under any such agreement into the appropriation accounts that incur the costs to be available immediately and to remain available until expended for Animal Damage Control activities."*

1.12.1.2 U.S. Fish and Wildlife Service (USFWS)

The USFWS is charged with implementation and enforcement of the ESA of 1973, as amended and with developing recovery plans for listed species. The U. S. Fish and Wildlife Service's (USFWS) authority for action is also based on the Migratory Bird Treaty Act of 1918 (as amended), which implements treaties with the United States, Great Britain (for Canada), the United Mexican States, Japan, and the Soviet Union for the conservation of migratory birds.

1.12.1.3 Missouri Department of Conservation (MDC) Legislative Authority

The MDC, under the direction of the Conservation Commission, is specifically charged by the General Assembly with the management of the State's wildlife resources. Although many legal mandates of the Conservation Commission and the Department are expressed throughout the Wildlife Code of Missouri, the primary statutory authorities include wildlife management responsibilities, public education charges, law enforcement authorities, and regulatory powers. Also, MDC has the statutory authority to manage damage to agriculture and property, and to protect human health and safety from damage involving mammals and birds.

1.12.1.4 Missouri Department of Agriculture (MDA)

The MDA is authorized by RSMO 261.090 to cooperate with "other agencies of the state government dealing with the production, handling and marketing of farm products in the interest of economy, harmony and efficient service and may also cooperate with the USDA and its sub-departments and with other states or organizations that have common agricultural problems with those of the State of Missouri.

1.12.1.5 Missouri Department of Health (MDH)

The MDH is authorized under RSMO192.020 to safeguard the health of the people in the State of Missouri and all its subdivisions. It shall study the causes and prevention of diseases and designate which diseases are infectious, contagious, communicable, or dangerous, and shall enforce adequate orders, findings, rules and regulations to prevent the spread of such diseases within the State of Missouri. Under RSMO192.110 and the Department of Health regulations, the Public Health Veterinarian shall take cognizance of any contagious diseases which may be prevalent among domestic animals of the state and which may be communicable or transferred to human beings. The State Public Health Veterinarian shall ascertain the nature and cause of such conditions and shall have the power and duty to administer all laws and orders and findings, to quarantine, prevent or to control the spread of such diseases.

1.12.1.6 Natural Resource Conservation Service (NRCS)

NRCS is responsible for certifying wetlands under the Wetland Conservation provisions of the Food Security Act (16 U.S.C. 3821 and 3822). Topographic maps are available through their offices that identify the presence of wetlands.

1.12.1.7 U.S. Army Corps of Engineers (COE)

The COE regulates and permits activities regarding waters of the United States including their protection and utilization under Section 404 of the Clean Water Act.

1.12.1.8 U.S. Environmental Protection Agency (EPA)

EPA is responsible for implementing and enforcing the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) which regulates the registration and use of pesticides. The EPA is also responsible for administering and enforcing the Section 404 program of the Clean Water Act with the COE; which established a permit program for the review and approval of water quality standards that directly impact wetlands.

1.12.2 COMPLIANCE WITH OTHER FEDERAL LAWS

Several other federal laws authorize, regulate, or otherwise affect WS wildlife damage management. WS complies with these laws, and consults and cooperates with other agencies as appropriate.

1.12.2.1 National Environmental Policy Act (NEPA)

All Federal actions are subject to NEPA (Public Law 91-190, 42 U.S.C. 4321 et seq.). WS follows the Council on Environmental Quality (CEQ) regulations implementing NEPA (40 CFR 1500 et seq.), USDA NEPA implementing regulations (7 CFR 1b), and the APHIS Implementing Procedures (7 CFR 372) as a part of the decision-making process. NEPA sets forth the requirement that Federal actions with the potential to significantly affect the human environment be evaluated in terms of their impacts for the purpose of avoiding or, where possible, mitigating and minimizing adverse impacts. Federal activities affecting the physical and biological environment are regulated, in part, by CEQ through regulations in Title 40, Code of Federal Regulations, Parts 1500-1508. In accordance with CEQ and USDA regulations, APHIS NEPA Procedures, as published in the Federal Register (44 CFR 50381-50384) provide guidance to APHIS regarding the NEPA process.

Pursuant to NEPA and CEQ regulations, this EA documents the analysis of a proposed Federal action's impact, informs decision-makers and the public of reasonable alternatives, and serves as a decision-aiding mechanism to ensure that the policies and goals of NEPA are infused into Federal agency planning and decision making. An EA is prepared by integrating as many of the natural and social sciences as may be warranted based on the potential effects of the proposed action. The direct, indirect, and cumulative impacts of the proposed action are analyzed.

1.12.2.2 Endangered Species Act (ESA)

It is federal policy, under the ESA, that all federal agencies shall seek to conserve threatened and endangered (T&E) species and shall utilize their authorities in furtherance of the purposes of the Act (Sec. 2 I). WS conducts Section 7 consultations with the U.S. Fish & Wildlife Service (USFWS) to use the expertise of the USFWS to ensure that "any action authorized, funded or carried out by

such an agency . . . is not likely to jeopardize the continued existence of any endangered or threatened species . . . Each agency shall use the best scientific and commercial data available" (Sec.7 (a)(2)). WS obtained a Biological Opinion (B.O.) from USFWS for the National WS Program in 1992 describing potential effects on T & E species and prescribing reasonable and prudent measures for minimizing risks to T&E species (USDA 1997 Revised, Appendix F). Missouri WS also consulted with the USFWS regarding the potential risks of ARDM techniques to T&E species in Missouri.

1.12.2.3 National Historic Preservation Act (NHPA) of 1966 as amended

The NHPA of 1966, and its implementing regulations (36 CFR 800), requires federal agencies to: 1) determine whether activities they propose constitute "undertakings" that have the potential to cause effects on historic properties and, 2) if so, to evaluate the effects of such undertakings on such historic resources and consult with the Advisory Council on Historic Preservation (i.e. State Historic Preservation Office, Tribal Historic Preservation Officers), as appropriate. WS actions on tribal lands are only conducted at the tribe's request and under signed agreement; thus, the tribes have control over any potential conflict with cultural resources on tribal properties.

The ARDM methods described in this EA that might be used operationally by WS do not cause major ground disturbance, do not cause any physical destruction or damage to property, do not cause any alterations of property, wildlife habitat, or landscapes, and do not involve the sale, lease, or transfer of ownership of any property. In general, such methods also do not have the potential to introduce visual, atmospheric, or audible elements to areas in which they are used that could result in effects on the character or use of historic properties. Therefore, the methods that would be used by WS under the proposed action are not generally the types of activities that would have the potential to affect historic properties. If an individual activity with the potential to affect historic resources is planned under an alternative selected as a result of a decision on this EA, then site-specific consultation as required by Section 106 of the NHPA would be conducted as necessary.

There is potential for audible effects on the use and enjoyment of a historic property when methods such firearms, explosives, or other noise-making methods are used at or in close proximity to such sites for purposes of removing aquatic rodents or beaver dams. However, such methods would only be used at a historic site at the request of the owner or manager of the site to resolve a damage or nuisance problem, which means such use would be to benefit the historic property. A built-in mitigating factor for this issue is that virtually all of the methods involved would only have temporary effects on the audible nature of a site and can be ended at any time to restore the audible qualities of such sites to their original condition with no further adverse effects. In some situations it may also be possible to schedule these activities at times when impact would be

minimized. Site-specific consultation as required by Section 106 of the NHPA would be conducted as necessary in those types of situations.

1.12.2.4 Environmental Justice and Executive Order 12898 – "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations."

Executive Order 12898, entitled, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" promotes the fair treatment of people of all races, income levels and cultures with respect to the development, implementation and enforcement of environmental laws, regulations and policies. Environmental justice is the pursuit of equal justice and protection under the law for all environmental statutes and regulations without discrimination based on race, ethnicity, or socioeconomic status. It is a priority within APHIS and WS. Executive Order 12898 requires Federal agencies to make environmental justice part of their mission, and to identify and address disproportionately high and adverse human health and environmental effects of Federal programs, policies and activities on minority and low-income persons or populations. APHIS implements Executive Order 12898 principally through its compliance with NEPA. All WS activities are evaluated for their impact on the human environment and compliance with Executive Order 12898. WS personnel use only legal, effective, and environmentally safe wildlife damage management methods, tools, and approaches. It is not anticipated that the proposed action would result in any adverse or disproportionate environmental impacts to minority and low-income persons or populations.

1.12.2.5 Protection of Children from Environmental Health and Safety Risks (Executive Order 13045)

Children may suffer disproportionately from environmental health and safety risks for many reasons. Wildlife damage management as proposed in this EA would only involve legally available and approved damage management methods in situations or under circumstances where it is highly unlikely that children would be adversely affected. Therefore, implementation of the proposed action would not increase environmental health or safety risks to children.

1.12.2.6 Executive Order 13112 – Invasive Species

This Executive Order directs Federal agencies to use their programs and authorities to prevent the spread of or to control populations of invasive species that cause economic or environmental harm, or harm to human health. Nutria are a non-native (invasive species) that have the potential to cause environmental harm or harm to human health. To comply with Executive Order 13112, WS may cooperate with other Federal, State or local government agencies, or with industry or private individuals to reduce nutria damage to the environment or threats to human health and safety.

1.12.2.7 The Clean Water Act (CWA; 33 U.S.C. 1344)

The CWA provides regulatory authority and guidelines for the EPA and the U.S. Army Corps of Engineers related to wetlands. Several Sections of the CWA pertain to regulating effects to wetlands. Section 101 specifies the objectives of this Act, which are implemented largely through Subchapter III (Standards and Enforcement), Section 301 (Prohibitions). The discharge of dredged or fill material into water of the United States is subject to permitting specified under Subchapter IV (Permits and Licenses of this Act). Section 401 (Certification) specifies additional regulatory authorities when wetlands exist in proximity to proposed activities or when such activities might impact wetland areas. Such consultations are designed to determine if any wetland will be affected by proposed actions.

Section 404 (33 USC 1344) of the CWA prohibits the discharge of dredged or fill material into waters of the United States without a permit from the USACE unless the specific activity is exempted in 33 CFR 323 or covered by a Nationwide Permit (NP) in 33 CFR 330. Breaching of most beaver dams is covered by these regulations (33 CFR 323 and 330).

1.12.2.8 Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)

FIFRA requires the registration, classification, and regulation of all pesticides used in the United States. The EPA is responsible for implementing and enforcing FIFRA. All chemical methods integrated into the Missouri WS program are registered with and regulated by the EPA and Missouri Department of Agriculture. All chemical methods used by WS would be in compliance with labeling procedures and requirements.

1.12.2.9 Food Security Act

The Wetland Conservation provision (Swampbuster) of the 1985 (16 USC 3801-3862), 1990 (as amended by PL 101-624), and 1996 (as amended by PL 104-127) farm bills require all agricultural producers to protect wetlands on the farms they own. Wetlands converted to farmland prior to December 23, 1985 are not subject to wetland compliance provisions even if wetland conditions return as a result of lack of maintenance or management. If prior converted cropland is not planted to an agricultural commodity (crops, native and improved pastures, rangeland, tree farms, and livestock production) for more than 5 consecutive years and wetland characteristics return, the cropland is considered abandoned. Once cropland is considered abandoned, the cropland becomes a wetland subject to regulations under Swampbuster and Section 404 of the CWA. The Natural Resource Conservation Service (NRCS) is responsible for certifying wetland determinations according to this Act.

1.12.3 COMPLIANCE WITH OTHER STATE LAWS

Owner May Protect Property 3CSR10-4.130

This regulation authorizes landowners or agents of the landowner to protect property, subject to federal regulations, from migratory birds and any other wildlife except deer, turkey, bear and any endangered species which beyond reasonable doubt is damaging property. With the exceptions noted, depredating wildlife may be captured or killed at any time without a permit. Deer, turkey, black bears and endangered species that are causing damage maybe killed only with the permission of an agent of the department, and by methods authorized by the agent.

CHAPTER 2: ISSUES AND AFFECTED ENVIRONMENT

2.0 INTRODUCTION

Chapter 2 contains a discussion of the issues identified by agencies and the public as being relevant to the development and selection of ARDM alternatives. These issues were also used to develop mitigation in Standard Operating Procedures (SOP's). This chapter also includes a discussion of the issues not considered in detail. Pertinent information on the affected environment is included in this chapter in the discussion of issues to be addressed in detail. Additional information on affected environments is incorporated into the discussion of environmental impacts in Chapter 4.

2.1 AFFECTED ENVIRONMENT

Upon request for assistance, aquatic rodent damage management could be conducted on private, federal, state, county, and municipal lands in Missouri to protect agricultural and natural resources, property, roads, bridges, railroads, and public health and safety. Areas of the proposed action could include state and interstate highways and roads, and railroads and their right-of-ways where beaver, nutria, and muskrat activities cause damage. Areas may also include property in or adjacent to subdivisions, businesses, and industrial parks where beaver impound water and gnaw or fell trees. Additionally, affected areas could include timberlands, croplands, and pastures that experience financial losses from beaver flooding or gnawing. The proposed action also could include private and public property where beaver, nutria, and muskrat burrowing causes damage to dikes, ditches, ponds, and levees, and where feeding causes agricultural crop losses and negatively impacts wildlife, including T&E species.

2.2 ISSUES ANALYZED IN DETAIL IN CHAPTER 4

The following are issues that have been identified as areas of concern requiring consideration in this EA and were used to develop mitigation measures:

1. Effects on beaver, nutria, and muskrat populations,
2. Effects on plants and other wildlife species, including T&E species,
3. Effects on public and pet health and safety,
4. Humaneness of methods to be used,
5. Effects on wetlands,
6. Economic losses to property, and
7. Impacts to stakeholders, including aesthetics.

2.2.1 Effects on Beaver, Nutria, and Muskrat Populations

There is concern that some alternatives could result in the loss of local beaver, nutria, and muskrat populations or could have a cumulative adverse impact on regional or statewide beaver, nutria, and muskrat populations.

The most beaver and muskrat annually lethally removed by Missouri WS were 247 beaver in fiscal year FY 02, and 637 muskrats in FY 01. MDC data indicate that even with current levels of sport harvest and removals for damage management, populations of both these species are increasing. To date MO WS has not conducted any activity that is directly intended for any nutria damage management. However, a small number of nutria have been unintentionally taken during beaver damage management projects (Table 4.2). Nutria populations in the state are currently believed to be increasing.

Based upon current and anticipated increase of work, and depending upon the Alternative selected, Missouri WS expects that no more than 500 nutria, 1,500 beavers and 3,000 muskrats would be removed annually while conducting WS direct control activities within the state.

2.2.2 Effects on Plants and other Wildlife Species, including T&E Species

A common concern among members of the public and wildlife professionals, including WS personnel, is that the proposed action or any of the alternatives would result in unintended death or injury of species not associated with the damage problem (non-target species), particularly T&E species.

2.2.2.1 Effects on Non-target Wildlife

A relatively small number of non-target animals may be captured and killed by Missouri WS annually depending upon the alternative selected. Non-target species such as otters, raccoons, and turtles are the species most likely to be captured in traps and snares. To reduce the risks of adversely affecting non-target species WS would use damage management methods that are as target-selective as possible and WS would apply such methods in ways to reduce the likelihood of capturing non-target species. Before initiating trapping or control, WS would select sites which are extensively used by the target species and use baits or lures which are preferred by the target species. WS SOPs are designed to reduce effects on non-target species and are presented in Chapter 3. Healthy, uninjured non-target animals would be released unharmed at the capture site

2.2.2.2 Effects on T&E Species (Plants and Animals)

There are currently 31 federally listed or candidate T&E species in Missouri (23 animals and 8 plants) according to USFWS, Missouri Ecological Services Field Office (Table 2.2).

Table 2.2 Federally listed T&E species that occur or are likely to occur in Missouri.

Common Name	Scientific Name	Status
Mammals		
Bat, gray	*Myotis grisescens*	Endangered
Bat, Indiana	*Myotis sodalis*	Endangered
Bat, Ozark big-eared	*Plecotus townsendii ingens*	Endangered
Birds		
Eagle, bald	*Hallaeetus leucocephalus*	Threatened
Least tern (Interior population)	*Sterna antillarum*	Endangered
Plover, piping	*Charadrius melodus*	Threatened
Reptiles		
Massasauga Eastern	*Sistrurus catenatus*	Candidate
Amphibians		
Hellbender, Ozark	*Cryptobranchus alleganiensis bishopi*	Candidate
Fish		
Cavefish, Ozark	*Amblyopsis rosae*	Threatened
Darter, Arkansas	*Etheostoma cragini*	Candidate
Darter, Niangua	*Etheostoma nianguae*	Threatened
Madtom, Neosho	*Noturus placidus*	Threatened
Sculpin, grotto	*Cottus sp.*	Candidate
Shiner, Topeka	*Notropis Topeka*	Endangered
Sturgeon, pallid	*Scaphirhynchus albus*	Endangered
Insects		
Dragonfly, Hine's emerald	*Somatochlora hineana*	Endangered
Mussels		
Mucket, Neosho	*Lampsilis rafinesqueana*	Candidate
Mussel, Scaleshell	*Leptodea leptodon*	Endangered
Pearlymussel, Curtis'	*Epioblasma florentina curtisi*	Endangered
Pearlymussel, Higgins' eye	*Lampsilis higginsii*	Endangered
Pearlymussel, pink mucket	*Lampsilis orbiculata*	Endangered
Pocketbook, fat	*Potamilus capax*	Endangered
Snails		
Cavesnail, Tumbling creek	*Antrobia culveri*	Candidate
Plants		
Aster, decurrent false	*Boltonia decurrens*	Threatened
Bladder-pod, Missouri	*Lesquerella filiformis*	Threatened
Clover, running buffalo	*Trifolium stoloniferum*	Endangered
Geocarpon	*Geocarpon minimum*	Threatened
Milkweed, Mead's	*Asclepias meadii*	Threatened
Orchid, Western prairie fringed	Platanthera praeclara	Threatened

Pondberry	*Lindera melissifolia*	Endangered
Sneezeweed, Virginia	*Helenium virginicum*	Threatened

Special efforts are made to avoid jeopardizing T&E species through evaluations of the potential effects of each of the proposed damage management techniques and the establishment of special restrictions or mitigation measures to reduce the risk of adversely impacting T&E species. WS consulted with the USFWS concerning potential impacts of aquatic rodent damage management methods on T&E species in Missouri. The USFWS concurs that Missouri WS ARDM methods are not likely to adversely affect threatened or endangered species or their critical habitats in Missouri with the exception of the use of zinc phosphide (ZP) (C.M. Scott, USFWS April 6, 2004). Missouri WS has addressed USFWS concerns regarding ZP under section 3.6.1 Mitigation and SOPs. Specifically, WS will abide by the USFWS recommendation that WS will not use ZP in areas where listed aquatic species (mussels and fish) are known to occur. Therefore WS use of ZP will not adversely affect any T&E species or critical habitat. If in the future it is determined necessary to use ZP where listed aquatic species (fish and mussels) are know to occur, WS will initiate consultation with the USFWS at that time.

WS also consulted with the USFWS under Section 7 of the ESA concerning potential impacts of its national wildlife damage management program on listed species (Appendix F USDA 1997 Revised). WS has reinitiated Section 7 consultation at the National level to assure that potential effects on T&E species have been adequately addressed.

Beaver dams impact stream ecosystems by damming streams, increasing sedimentation and water temperatures, thereby adversely affecting wildlife that depend on clear, cool water, such as certain T&E species of mussels and fish. In Missouri, these species may include the Neosho madtom (*Noturus placidus*), Niangua darter (*Etheostoma nianguae*), Curtis' Pearlymussel (*Epioblasma florentina curtisi*), Pink mucket (*Lampsilis orbiculata*) and Scaleshell mussel (*Leptodea leptodon*).

2.2.2.3 Effects on Native Plants

Removal of beaver, nutria, and muskrats and breaching/removing beaver dams would be beneficial to some native plant species that may be killed by foraging aquatic rodents and flooding related the creation of beaver dams and the failure of water management structures due to the burrowing activities of aquatic rodents. Increased soil moisture associated with excess flooding may result in reduced plant or timber growth and vitality and could be detrimental to some wildlife species through a decrease in mast (e.g., acorn, hickory nut) production. Conversely, as discussed in section 1.4.2, beaver ponds that remain in place over a period of years allow for the establishment of certain other species of aquatic vegetation and are valuable habitat to a variety of species.

2.2.3 Effects on Public and Pet Health and Safety

A common concern is whether the proposed action or any of the alternatives pose a threat to public and pet health and safety. In particular, there is concern that lethal methods of beaver, nutria, and muskrat removal (i.e., trapping, shooting, chemical toxicants) and explosives used in dam removal may be hazardous to people and pets. WS SOPs include measures intended to mitigate or reduce the effects on human and pet health and safety and are presented in Chapter 3. Another common concern, discussed in Chapter 1, is that continued increases in beaver, nutria, and muskrat populations might threaten public and pet health or safety.

2.2.4 Humanness of Methods to be Used

The issue of humaneness, as it relates to the killing or capturing of wildlife is an important but very complex concept that can be interpreted in a variety of ways. Humaneness is a person's perception of harm or pain inflicted on an animal, and people may perceive the humaneness of an action differently. People concerned with animal welfare are concerned with minimizing animal suffering as much as possible, or eliminating unnecessary suffering. The determination of what is unnecessary suffering is subject to debate (Schmidt 1989). Schmidt (1989) indicated that vertebrate pest damage management for societal benefits could be compatible with animal welfare concerns if ". . . *the reduction of pain, suffering, and unnecessary death is incorporated in the decision making process.*"

Suffering is described as a ". . . *highly unpleasant emotional response usually associated with pain and distress.*" However, suffering ". . . *can occur without pain . . .*" and ". . . *pain can occur without suffering . . .*" (American Veterinary Medical Association (AVMA) 1987). Because suffering carries with it the implication of a time frame, a case could be made for ". . . *little or no suffering where death comes immediately . . .*" (California Department of Fish and Game (CDFG) 1991), such as shooting.

Measuring pain as a component of humaneness in WS methods appears to be a greater challenge than that of suffering. Pain obviously occurs in animals. Altered physiology and behavior can be indicators of pain, and identifying the causes that elicit pain responses in humans would ". . . *probably be causes for pain in other animals . . .*" (AVMA 1987). Research suggests that some methods, such as restraint in leg-hold traps or changes in the blood chemistry of trapped animals, indicate "*stress*" (USDA 1997 Revised). However, such research has not yet progressed to the development of objective, quantitative measurements of pain for use in comparing the relative humaneness of different damage management techniques.

The AVMA states "... *euthanasia is the act of inducing humane death in an animal*" and "... *the technique should minimize any stress and anxiety experienced by the animal prior to unconsciousness.*" (Beaver et al. 2001). Some people would prefer AVMA accepted methods of euthanasia to be used when killing all animals, including wild and feral animals. The AVMA states that "*For wild and feral animals, many of the*

recommended means of euthanasia for captive animals are not feasible. In field circumstances, wildlife biologists generally do not use the term euthanasia, but terms such as killing, collecting, or harvesting, recognizing that a distress-free death may not be possible." (Beaver et al. 2001).

Analysis of this issue must consider not only the welfare of the animals captured, but also the welfare of humans, livestock and some T&E species if damage management methods are not used. The challenge in coping with this issue is how to achieve the least amount of animal suffering with the constraints imposed by current technology. WS personnel are concerned about animal welfare. WS is aware that techniques like snares and traps are controversial, but also believes that these activities are being conducted as humanely and responsibly as practical. WS and the National Wildlife Research Center are striving to bring additional non-lethal damage management alternatives into practical use and to improve the selectivity and humaneness of management devices. Until new findings and products are found practical, a certain amount of animal suffering could occur when some methods are used in situations when non-lethal damage management methods are not practical or effective. WS supports the most humane, selective, and effective damage management techniques, and would continue to incorporate advances into program activities.

Missouri WS personnel are experienced and professional in use of management methods to increase humaneness as much as possible under the constraints of current technology, workforce, and funding. SOPs used to maximize humaneness are listed in Chapter 3. Furthermore, MDC Wildlife Code 3 CSR 10-8.510 requires that traps be checked on a daily basis.

Some people are concerned about the humaneness of drowning beaver, nutria, and muskrats while restrained by leg-hold traps. Considerable debate and disagreement among animal activists, veterinarians, wildlife professionals, fur trappers, and nuisance wildlife specialists is apparent. Debate centers around an uncertainty as to whether drowning animals are rendered unconscious by high levels of carbon dioxide (CO_2) and thus insensitive to distress and pain (Ludders et al. 1999). The AVMA identifies drowning as an unacceptable method of euthanasia (Beaver et al. 2001), but provides no details on the reasons for this decision. Ludders et al. (1999) concluded drowning is not euthanasia based on the animals not dying from CO_2 narcosis, because CO_2 narcosis does not occur until 95 millimeters of mercury in arterial blood is exceeded. Ludders et al. (1999) showed death during drowning is from hypoxia and anoxia, and thus animals experience hypoxemia. Ludders et al. (1999) also concluded that animals that drown are distressed because of stress related hormones, therefore, drowning is not euthanasia.

CO_2 causes death in animals by hypoxemia (inadequate oxygenation of the blood) and some animals (i.e. cats, rabbits, and swine) are distressed before death (Beaver et al. 2001). Even though these animals are distressed, the AVMA states this death is an acceptable form of euthanasia (Beaver et al. 2001). Thus, the AVMA does not preclude distress or pain in euthanasia. In fact, the AVMA supports inducing hypoxemia related

distress when necessary to reduce total distress, because reducing total distress is a more humane death.

Death by drowning in the classical sense is caused by inhalation of fluid into the lungs and is referred to as wet drowning (Gilbert and Gofton 1982, Noonan 1998). Gilbert and Gofton (1982) reported that all submerged beaver do not die from wet drowning, but die of of oxygen deprivation after a period of CO_2 induced stupor (narcosis). According to Gilbert and Gofton (1982) and Noonan (1998), the AVMA accepts CO_2 as a suitable form of euthanasia. However the 2000 AVMA report on Euthanasia only considers use of CO_2 acceptable or provisionally acceptable if administered under tightly controlled conditions including requiring that the only acceptable source of CO_2 is bottled gas because of the amount of CO_2 administered can be carefully controlled (Beaver et al. 2001). Gilbert and Gofton (1982) also reported that after beaver were trapped and entered the water struggling occurred for 2-5 minutes followed by a period of reflexive responses. Andrews et al. (1993) reports that with some techniques that induce hypoxia, some animals have reflex motor activity followed by unconsciousness that is not perceived by the animal. Gilbert and Gofton (1982) stated it is unknown how much conscious control actually existed at this stage and oxygen deprivation may have removed much of the sensory perception by 5-7 minutes post submersion. However, Gilbert and Gofton (1982) have been criticized because levels of CO_2 in the blood were not reported (Ludders et al. 1999) and there was insufficient evidence that the beaver in their study were under a state of CO_2 narcosis when they died. Adding to the controversy, Clausen and Ersland (1970) did measure CO_2 in the blood for submersed restrained beaver, yet none of the beaver in the study died. Therefore, Clausen and Ersland (1970) could not determine the exact cause of death. However, Clausen and Ersland (1970) were able to demonstrate that CO_2 increased in arterial blood while beaver were submersed and that CO_2 was retained in tissues. While Clausen and Ersland (1970) did measure the amounts of CO_2 in the blood of submersed beaver they did not attempt to measure the desensitizing effect of CO_2 buildup in beaver.

When beaver are captured using leg-hold traps with intent to drown, beaver are exhibiting a flight response. Gracely and Sternberg (1999) reported that there is stress-induced reductions in sensitivity to pain during fight and flight responses. Environmental stressors that animals experience during flight or fight activate the similar stress-induced reductions in sensitivity to pain as capture in traps (Gracely and Sternberg 1999).

Use of drowning trap sets has been a traditional wildlife management technique in trapping aquatic mammals such as beaver, nutria, and muskrats. Trapper education manuals and other wildlife damage management manuals written by wildlife biologists recommend drowning sets for leghold traps set for beaver (Howard et al. 1980, Randolph 1988, Bromley et al. 1994, Dolbeer et al. 1994, Miller and Yarrow 1994). Drowning trap sets are considered by some to be the most appropriate and effective method available to capture beaver, nutria, and muskrats for some situations. These people generally perceive the relatively short time to death from drowning (minutes) to be preferable to the potential pain, stress and distress an animal might experience while

in a live capture device (hours) until eventually euthanized. Animals in live capture devices are vulnerable to being harassed, killed or injured by humans, dogs, or other wildlife (Miller and Yarrow 1994). Drowning sets make the captured animal and trap less visible and prevent injury (i.e., bites and scratches) to people who may otherwise approach a restrained animal. Some sites may be unsuitable for body-gripping traps or snares because of unstable banks, deep water, or substrate conditions. However, these sites may be suitable for leghold traps.

Given the relatively short time period of a drowning event compared to being held in a live capture device, possible analgesic effect of CO_2 buildup to beaver, acceptance of catching and drowning muskrats approved by International Humane Trapping Standards, the conclusion has been drawn that drowning, though rarely used by WS, will continue to be included as an available method in alternatives that allow for lethal methods of ARDM. Some people will disagree and remain un-swayed.

2.2.5 Effects on Wetlands

Some people are concerned about the effects of the alternatives on wetland ecosystems, specifically that the removal of beaver or breaching/removing beaver dams from an area will result in the loss of wetland habitat and the plant and animal species included in those habitats.

Beaver build dams primarily in smaller rivers (intermittent and perennial streams and creeks) with dams consisting of mud, sticks, and other vegetative materials. Dams obstruct the normal flow of water and typically change the preexisting wetland hydrology from flowing or circulating waters to slower, deeper, more expansive waters that accumulate bottom sediment. Depth of the bottom sediment depends on the length of time an area is covered by water and the amount of suspended sediment in the water. If a beaver dam is not breached/removed and water levels remain constant, hydric soils and hydrophytic vegetation eventually form. This process can take anywhere from several months to years depending on preexisting conditions. Hydric soils are those soils that are saturated, flooded, or submerged long enough during the growing season to develop anaerobic conditions. In general, hydric soils form much faster in areas where wetlands have previously existed. Hydrophytic vegetation includes those plants that grow in water or on a substrate that is at least periodically deficient in oxygen as a result of excessive water content. If these conditions are met, a wetland can develop that would have different wildlife habitat values than an area recently impounded by beaver dam activity.

Some species will benefit from the addition of a beaver dam, while others will diminish. For example, some species of darters listed as federally endangered require fast moving waters over gravel or cobble beds which beaver dams can eliminate, thus reducing the habitat's value for these species. In general, it has been found that terrestrial wildlife habitat values decline around bottomland beaver impoundments in the southern US, because hardwood trees are killed from flooding and mast production declines. On the

other hand, beaver dams can potentially be beneficial to species of wildlife such as river otters, Neotropical birds, and waterfowl.

WS beaver damage management activities would primarily be conducted to alleviate damages to agricultural crops, timber resources, and public property such as roads, bridges, and water management facilities. ARDM would also be conducted to enhance or reclaim wildlife and stream fishery/mussel habitats. Activities most often take place on small watershed streams, tributary drainages, and ditches and can best be described as small, one-time projects conducted to restore water flow through previously existing channels. Under the preferred alternative, WS would routinely incorporate beaver removal with dam breaching/removing and/or installation of water control devices and beaver exclusion devices. Dams would be breached/removed by hand when possible, or small charges of binary explosives could be used when necessary. No heavy equipment such as backhoes or bulldozers would be used by WS in these damage reduction and wildlife enhancement activities. Only the portion of the dam blocking the stream or ditch channel is altered or breached. Projects involving the use of binary explosives would be conducted by trained WS certified explosive specialists. After a blast, any remaining fill material still obstructing the channel is normally washed downstream by water current. The only noticeable side effects from this activity are diluted mud, water, and small amounts of debris from the dam scattered around the blasting site. Considerably less than 10 cubic yards of material would be moved in each of these project activities.

The United States Army Corps of Engineers (USACE) has criteria that would be implemented by WS during dam breaching/removal activities to minimize any impacts to the water course basin, adjacent riparian areas, or surrounding vegetation (see Appendix C). The intent of most dam breaching/removal is not to drain established wetlands. With few exceptions, requests from public and private individuals and entities involve dam breaching/removal to return an area back to its preexisting condition. Hydric soils and wetland conditions usually take many years to develop, often greater than 5 years as recognized by Swampbuster provisions. Most beaver dam removal by WS is either exempt from regulation under Section 404 of the Clean Water Act as stated in 33 CFR part 323 or may be authorized under the USACE Nationwide Permit System in 33 CFR part 330. However, breaching/removal of some beaver dams can involve certain portions of Section 404 to require landowners to obtain permits from the USACE. WS personnel determine the proper course of action upon inspecting a beaver dam impoundment. Appendix C describes the procedures used by WS to assure compliance with the pertinent laws and regulations.

2.2.6 Economic Losses to Property

Some people are concerned about the negative economic impacts that beaver, nutria, and muskrats are having on property. These people are concerned as to whether the proposed action or any of the alternatives would reduce such damage to acceptable levels.

2.2.7 Impacts to Stakeholders, including Aesthetics

Some concern exists that the proposed action or the alternatives would result in loss of aesthetic benefits to the public, landowners/resource managers, or neighboring residents. Wildlife generally is regarded as providing economic, recreational, and aesthetic benefits (Decker and Goff 1987), and the mere knowledge that wildlife exists is a positive benefit to many people. Aesthetics is the philosophy dealing with the nature of beauty, or the appreciation of beauty. Therefore, aesthetics is truly subjective in nature, dependent on what an observer regards as beautiful.

Wildlife populations provide a range of social and economic benefits (Decker and Goff 1987). These include direct benefits related to consumptive and non-consumptive use (e.g. wildlife-related recreation, observation, harvest, sale), indirect benefits derived from various wildlife related experiences (e.g., reading, television viewing), and the personal enjoyment of knowing wildlife exists and contributes to the stability of natural ecosystems (e.g., ecological, existence, bequest values) (Bishop 1987). Direct benefits are derived from a user's personal relationship to animals and may take the form of direct consumptive use (using up the animal or intending to) or non-consumptive use (viewing the animal in nature or in a zoo, photography) (Decker and Goff 1987). Indirect benefits or indirect exercised values arise without the user being in direct contact with the animal and come from experiences such as looking at photographs and films of wildlife, reading about wildlife, or benefiting from activities or contributions of animals such as their use in research (Decker and Goff 1987). Indirect benefits come in two forms: (1) bequest which is providing for future generations, and (2) pure existence which is merely knowledge that the animals exist (Decker and Goff 1987).

What constitutes an acceptable wildlife damage management technique and an acceptable impact on the aesthetic value of aquatic rodents and beaver ponds is highly subjective. Many people directly affected by problems and threats to public health or safety caused by beaver, nutria, or muskrats insist upon removal of aquatic rodents from the property or public location when damage is apparent. Some people believe that all wildlife damage problems should be resolved by capturing and relocating problem animals to another area. Individuals not directly affected by the harm or damage may be supportive, neutral, or totally opposed to any removal of wildlife from specific locations or sites. People who are totally opposed to beaver, nutria, or muskrat damage management want WS to teach tolerance for damage and threats to public health or safety, and that wildlife should never be killed. Some people who oppose removal of wildlife do so because of human-affectionate bonds with individual animals. These human-affectionate bonds are similar to attitudes of a pet owner and result in aesthetic enjoyment of individual animals.

Missouri WS only conducts beaver, nutria, and muskrat damage management at the request of the affected landowner/resource manager. WS gives preference to non-lethal methods when effective and practical methods are available. When WS receives requests from an individual or official for beaver, nutria, or muskrat damage management, concerns regarding the humaneness and aesthetic value of aquatic rodents

would be incorporated in the development of a management strategy via the use of the WS Decision Model (Chapter 3). Management actions would be carried out in a caring, humane, and professional manner.

2.3 ISSUES NOT CONSIDERED IN DETAIL WITH RATIONALE

2.3.1 WS Impact on Biodiversity

Missouri WS beaver, nutria, or muskrat damage management is not conducted to eradicate native wildlife populations. WS works with MDC to ensure that damage management action do not result in adverse impacts on muskrat and beaver populations. WS operates according to International, Federal, and State laws and regulations enacted to ensure species viability. In addition, any reduction of a local group of beaver or muskrat is frequently temporary because immigration from adjacent areas or reproduction replaces removed animals. WS operates on a relatively small percentage of the land area of the State, and WS' take of any wildlife species analyzed in this EA is a small proportion of the total population and insignificant to the viability and health of the population (*see* Section 4.2.3). Reductions in nutria are likely to be beneficial because nutria are a non-native species which disrupts ecosystems and competes for resources with native wildlife species.

2.3.2 No Wildlife Damage Management at Taxpayer Expense (wildlife damage management should be fee based)

Funding for Missouri WS comes from a variety of sources including Federal appropriations. Federal congressional funds, Missouri State agency funds, county funds, city funds, private funds, and other Federal agency funds are applied to the WS program under Cooperative Agreements. Federal, State, and local officials have decided that wildlife damage management should be conducted by appropriating funds. WS was established by Congress as the agency responsible for providing wildlife damage management to US citizens. Wildlife damage management is an appropriate sphere of activity for government programs, since aspects of wildlife damage management are a government responsibility and authorized and directed by law.

2.3.3 Beaver, Nutria, and Muskrat Damage Should be Managed by Trappers and Nuisance Wildlife Control Agents

The jurisdiction for managing most resident wildlife rests with the MDC. Currently, MDC manages beaver and muskrats as furbearers while nutria are considered a pest (Dave Hamilton, MDC Biologist, personal communication 2004).

The number of recreational fur trappers in Missouri has drastically declined in the past few decades. According to data from the MDC, the number of trapping licenses sold annually decreased from a peak of 13,300 licenses in 1980 to a low of 2,500 in 1991, with approximately 4,000 sold in 2003 (Dave Hamilton, MDC Biologist, personal communication 2004). Recreational fur trappers provide several societal services, including trapping beaver causing damage to property and assisting the MDC to manage

beaver populations. One cause for the decline in recreational trapping has been lower prices paid for raw fur since the early 1980's. Subsequently, an insufficient number of trappers are present to manage expanding beaver populations. In addition, many beaver, nutria, and muskrat damage problems also occur in urban or developed areas where little or no recreational beaver trapping occurs.

Most private trappers cannot afford to provide year-around site-specific beaver, nutria, or muskrat damage management. However, the option of using a private trapper remains open to landowners experiencing damage or threats of damage. Private trappers, nuisance wildlife control agents, and landowners could trap beaver, nutria, and muskrat to alleviate damage during the regulated trapping season, or outside of the regulated season. However, some trappers are not willing to trap in urban areas for aesthetic reasons or fear of trap theft. Trappers also may not be willing to trap beaver, nutria, or muskrat outside of the regular trapping season because the furs lack quality and have little or no economic value.

Site-specific damage management has been necessary to protect property, roads, bridges, and agricultural and natural resources. It is the policy of WS to provide professional damage management upon request and verification of damage at site-specific locations. Assistance from Missouri WS may be requested to achieve management objectives. Typically, damage management involves removing a small number of beaver, nutria, or muskrats from a localized area. WS is not involved in statewide or large scale beaver, nutria, or muskrat population reduction (See Section 1.3). Targeted beaver, nutria, and muskrat populations include those found near damage sites (i.e. site-specific areas, such as bridges, critical wildlife habitat, managed forests, and ornamental trees and shrubs).

Some landowners/resource mangers may prefer that a government agency trap beaver, nutria, or muskrats instead of using private trappers or nuisance wildlife control agents, and large landowners/resource managers with numerous damage sites (i.e. railroads or highway departments) may prefer to use WS because of reduced administrative burden. Some landowners/resource managers may prefer to use private trappers or nuisance wildlife control agents instead of WS. Thus, WS beaver, nutria, and muskrat damage management activities would not eliminate opportunities for private trappers or nuisance wildlife control agents. Any actions by WS would be conducted in accordance with Wildlife Services Directive 4.220 Avoidance of Competition with Private Business.

2.3.4 Breaching/Removal of Dams or Use of Water Control Structures

This issue addresses attempts to alleviate flooding damage by controlling the water level at the site without removing beaver. Dams would be breached/removed manually or with binary explosives, but these methods are usually ineffective because beaver will quickly repair or replace the dam (McNeely 1995). Alternatively, damage may be managed by installing devices to control water levels in ponds. Installing and maintaining water control structures; or removing beaver dams on a daily or weekly basis, may be cost prohibitive. In addition the installation of water control structures or just removing dams

would not alleviate damage from gnawing or felling of trees or the damage associated with burrowing activities.

Water control devices and pond levelers have been used for many years in many different states, with varying degrees of success (USGAO 2001). Various types of beaver pond levelers have been described (Arner 1964, Roblee 1984, Laramie and Knowles 1985, Lisle 1996) and installation of beaver pond levelers can be effective in reducing flooding in certain situations (Miller and Yarrow 1994, Minnesota Department of Natural Resources 1994, Organ et al. 1996) if properly maintained. One study reported water drainage pipes in beaver dams to be effective in only about 5% of flooding situations (Anonymous 1999). Nolte et al. (2000) reported only 50% of installed pond levelers in Mississippi meet landowner objectives and found that pond levelers placed in sites with high beaver activity more frequently failed if installed without implementing population control measures. Ninety-five percent of the successful levelers in this study were at sites that had received some local population control measure either before, after, or before and after the leveler was installed (Nolte et al. 2000). Reasons for lack of success were described as blocking caused by debris or silt and nearby dam building (McNeely 1995). Wood et al. (1994) also acknowledged that pond levelers do not negate the need for reduction of local beaver populations. In Mississippi, beaver often build dams upstream and downstream of water control devices or block the device with mud and debris which renders this method ineffective (B. Sloan, USDA/APHIS/WS, personal communication). Suppression or eradication of the local beaver population usually is required for this method to be effective (B. Sloan, USDA/APHIS/WS, personal communication).

Pond levelers installed to manage wetlands for waterfowl habitat were more successful than levelers installed to provide relief from flooding (Nolte et al. 2000). Water control devices are most effective on wetlands lacking in-stream flow (B. Sloan, USDA/APHIS/WS, personal communication), but may be ineffective in beaver ponds in broad, low-lying areas (Organ et al. 1996). They may not be appropriate in streams or ditches with continuous flow because the volume of water is too great for the device to handle, and debris is continuously carried to the site. Water control devices may not be effective during periods of unusually high rainfall or increased water flow, because the device cannot handle the increased volume of water (Anonymous 1999, Wood et al. 1994).

Use of pond levelers or water control devices may require frequent maintenance depending on the type of water control device. Continued maintenance is necessary for the device to remain operational because stream flow, leaf fall, floods and beaver activity will continuously bring debris to the intake of the water control device. Maintenance and upkeep of water control devices vary from site to site but can be expensive. The Maine WS program estimated annual maintenance costs to be approximately $350/water control device. Mississippi WS reported the construction and installation cost of pond levelers to cost approximately $700. Annual costs may also be associated with suppressing beaver populations to keep the devices operational (B. Sloan, USDA/APHIS/WS, personal communication).

The Beaver Deceiver is a relatively recent water control system that attempts to quiet, calm and deepen the water around culverts (to reduce the attractiveness to beaver) and exclude beaver from a wide area around the upstream opening of the culvert (Lisle 1996). A critical part of the beaver deceiver strategy is to silence or prevent the sound of running water. The beaver deceiver is a water control system that has been evolving since 1996 and has been effective at controlling beaver flooding in some situations. Preservation of the fur resource for recreational trapping is one of the benefits of using beaver deceivers (Lisle 1996).

WS could implement use of water control devices as part of an integrated beaver management program at appropriate sites. Maine WS program installed over 160 water control devices in 1998. Primary benefit of use of these devices in Maine is to minimize flooding damage while leaving beavers for fur trappers to remove during the regulated trapping season each year (E. Butler, USDA/APHIS/WS, personal communication). Mississippi WS program commonly installs water control devices at sites managed for waterfowl and for perpetual water flow (B. Sloan, USDA/APHIS/WS, personal communication). Thus, in both Maine and Mississippi, use of water control devices is supplemented by continual removal of beaver from the site, and an additional benefit is received which helps to justify the expense (i.e. reserving beaver for the fur harvest, providing waterfowl habitat). Also, the construction, installation, and maintenance costs of water control devices in Maine and Mississippi are funded, in part, by sources such as state wildlife agencies, county governments, USFWS, or private organizations (E. Butler, USDA/APHIS/WS, personal communication, B. Sloan, USDA/APHIS/WS, personal communication).

One benefit of water control devices is that the beaver created pond or area can be maintained or improved, along with the ecological and recreational benefits derived from these areas, while the damage from beaver flooding is alleviated or at least reduced. However, water control devices are not applicable or efficient in all damage situations. Landowners consider many factors in determining the course of action to resolve beaver damage problems. For example, landowners must consider the cost of control, the probability that the method will resolve the problem, the amount of maintenance required, and whether the method is consistent with objectives for the property (Nolte et al. 2000). Water control devices are most effective in specific types of terrains and sites (NYDEC 1997, Wood et al. 1994). Water control devices require frequent maintenance and may be costly to install and maintain (Jensen et al. 1999, NYDEC 1997). Jensen et al. (1999) reported that the initial costs for a Clemson Beaver Pond Leveler and a Pitchfork Guard/Grate in the first year, including the costs of materials, installation, and maintenance, were $1,542 and $3,688, respectively. The cost of a Beaver Deceiver may range from $150 - S1,500, and an additional cost would be applied if pipes were needed at the site (S. Lisle, Penobscot Nation, letter to J. Cromwell, WS, September 7, 2000).

Water control devices could be used or recommended as part of the aquatic rodent program, if appropriate. Missouri WS provides information on installation of water control devices to those persons requesting assistance. In these situations it is the responsibility of the person requesting assistance to construct and install the device. If a

water control device is consistent with the landowner's objectives, and would alleviate the damage, then WS would recommend their use.

2.3.5 Appropriateness of Preparing an EA (instead of an EIS) for such a Large Area

Some individuals might question whether preparing an EA for an area as large as the state of Missouri would meet the NEPA requirements for site specificity. If in fact a determination is made through this EA that the proposed action would have a significant environmental impact, then an EIS would be prepared. In terms of considering cumulative impacts, one EA analyzing impacts for the entire state may provide a better analysis than multiple EAs covering smaller zones. Additionally, although this EA addresses impacts that may occur if WS conducts aquatic rodent damage management anywhere in the state of Missouri, in actuality Missouri WS only conducts aquatic rodent damage management in a very small proportion of the state where damage is occurring or likely to occur.

CHAPTER 3: ALTERNATIVES

3.0 INTRODUCTION

This chapter consists of seven parts: 1) introduction, 2) description of alternatives considered and analyzed in detail including the Proposed Action (Alternative 3), 3) beaver, nutria, and muskrat damage management approaches used by WS, 4) beaver, nutria, and muskrat damage methods authorized for use or recommended, 5) methodologies recommended but deemed impractical, ineffective, or unsafe at the present time, 6) a description of alternatives considered, but eliminated from detailed analysis, and 7) mitigation in standard operating procedures. Alternatives were developed for consideration using the WS Decision Model (Slate et al. 1992), Methods of Control (USDA 1997 Revised), and "*Risk Assessment of Wildlife Damage Control Methods Used by the USDA Animal Damage Control Program*" (USDA 1997 Revised).

3.1 ALTERNATIVES CONSIDERED, INCLUDING THE PROPOSED ACTION

Five alternatives were recognized, developed, and analyzed in detail. An additional six alternatives were considered, but not analyzed in detail. The five alternatives analyzed in detail are:

3.1.1 Alternative 1 - No WS Beaver, Nutria, or Muskrat Damage Management in Missouri

This alternative would result in no assistance from WS in reducing beaver, nutria, or muskrat damage in Missouri. All requests for beaver, nutria, or muskrat damage management assistance would be referred to the MDC, local animal control agencies, or private businesses or organizations. Assistance may or may not be available from any of these entities.

3.1.2 Alternative 2 - Only Lethal Beaver, Nutria, and Muskrat Damage Management

Under this alternative, WS would only provide technical assistance and operational beaver, nutria, and muskrat damage management for lethal management techniques. Non-lethal capture devices such as snares, leghold traps, and cage traps could be used under this alternative. However, all aquatic rodents captured in these non-lethal devices would subsequently be euthanized. The WS Decision Model (Section 3.2.3) would be used to select among the lethal management alternatives available to WS in order to meet the needs of the specific damage situation while minimizing potential harmful effects of damage management measures on humans, target and non-target species, and the environment. Requests for information regarding non-lethal management approaches would be referred to MDC, local animal control agencies, or private businesses or organizations. WS would not remove or breach beaver dams under this alternative. Individuals or agencies might choose to implement WS lethal recommendations on their own, implement non-lethal methods or other methods not recommended by WS, contract

for WS assistance with lethal management techniques, use contractual services of private businesses, use volunteer services, or take no action. WS would provide assistance with lethal aquatic rodent damage management when requested on private or public property only after an *Agreement for Control* or other comparable document has been completed and funding has been secured. All WS aquatic rodent damage management would be consistent with other uses of the area and would comply with appropriate Federal, State and local laws.

3.1.3 Alternative 3- Fully Integrated Beaver, Nutria, and Muskrat Damage Management for all Public and Private Land (No Action/Proposed Action)

The No Action alternative is a procedural NEPA requirement (40 CFR 1502.14(d)) and is a viable and reasonable alternative that could be selected and serves as a baseline for comparison with the other alternatives. The No Action alternative, as defined here, is consistent with guidance from the CEQ (CEQ 1981). In this guidance, the No Action alternative for situations where there is an ongoing management program may be interpreted as "no change" from current management direction or level of management intensity.

WS proposes to continue the current ARDM program in the state of Missouri. An IWDM approach, including technical assistance and operational damage management services, would be implemented to reduce beaver, nutria and muskrat damage to property, roads, bridges, railroads, agricultural and natural resources, and risks to public health and safety. Damage management would be conducted on public and private property in Missouri where a need exists and when landowners/managers request WS assistance. The IWDM strategy would encompass the use of practical and effective non-lethal and lethal methods of preventing or reducing damage while minimizing harmful effects of damage management measures on humans, target and non-target species, and the environment. The WS Decision Model (Slate et al. 1992; Section 3.2.3) would be used to select among the full range of management methods available when developing site-specific plans to address aquatic rodent damage. When appropriate, physical exclusion or habitat modification could be recommended and utilized to reduce aquatic rodent damage. Other non-lethal methods may include but are not limited to textural barriers, Clemson beaver pond levelers and exclusions devices. Aquatic rodents captured in non-lethal devices (leg-hold traps, snares, cage traps, etc.) would subsequently be euthanized. In other situations problem animals would be removed as humanely as possible using: body gripping traps (e.g., Conibear-type), snares, zinc phosphide bait for muskrats and nutria, leg-hold traps and shooting. When appropriate, beaver dams could be removed by using binary explosives or by hand. Preference would be given to practical and effective non-lethal methods, but non-lethal methods may not always be applied as a first response to each damage problem. The most appropriate response could be a combination of non-lethal and lethal methods, or there could be instances where application of lethal methods alone would be the most appropriate strategy. All WS aquatic rodent damage management would be consistent with other uses of the area and would comply with appropriate Federal, State and local laws.

3.1.4 Alternative 4- Technical Assistance Only

This alternative would only allow Missouri WS to provide technical assistance to individuals or agencies requesting beaver, nutria, or muskrat damage management in Missouri. WS would not remove or breach beaver dams under this alternative. The WS Decision Model (Section 3.2.3) would be used when recommending management alternatives that meet the needs of the specific damage situation. Landowners/managers could implement their own aquatic rodent damage management program, use contractual services of private businesses, use volunteer services, or take no action. This alternative would place the immediate burden of operational damage management work on the property owners and other Federal, State, or county agencies. All WS technical assistance for aquatic rodent damage management would be consistent with other uses of the area and would comply with appropriate Federal, State and local laws.

3.1.5 Alternative 5- Non-lethal Beaver, Nutria, and Muskrat Damage Management

Under this alternative, only non-lethal operational damage management and technical assistance would be provided by WS. The WS Decision Model (Section 3.2.3) would be used to select among the non-lethal management alternatives available to WS in order to meet the needs of the specific damage situation. Requests for information regarding lethal management approaches would be referred to MDC, local animal control agencies, or private businesses or organizations. Individuals or agencies might choose to implement WS non-lethal recommendations on their own, implement lethal methods or other methods not recommended by WS, contract for WS non-lethal damage management services, use contractual services or private businesses, use volunteer services, or take no action. Unwanted beaver dams could be removed or breached by hand or with binary explosives under this alternative. WS would provide assistance with non-lethal aquatic rodent damage management on private or public property only after an *Agreement for Control* or other comparable document has been completed and funding has been secured. All WS aquatic rodent damage management would be consistent with other uses of the area and would comply with appropriate Federal, State and local laws.

3.2 BEAVER, NUTRIA, AND MUSKRAT DAMAGE MANAGEMENT APPROACHES USED BY WS

Wildlife damage management is defined as the alleviation of damage or other problems caused by or related to the presence of wildlife (USDA 1997 Revised). The wildlife damage management approach currently used by WS to address aquatic rodent damage in Missouri is described below:

3.2.1 Integrated Wildlife Damage Management (IWDM)

During more than 80 years of resolving wildlife damage problems, WS has considered, developed, and used numerous methods of reducing damage problems (USDA 1997 Revised). WS efforts have involved the research and development of new methods and the implementation of effective strategies to resolve and prevent wildlife damage.

Usually, the most effective approach to resolving wildlife damage is to integrate use of several methods simultaneously or sequentially. IWDM is the implementation and application of safe and practical methods for the prevention and reduction of damage caused by wildlife based on local problem analyses and the informed judgment of trained personnel. WS program applies IWDM, commonly known as Integrated Pest Management (IPM; WS Directive 2.105), to reduce damage through the WS Decision Model (Slate et al. 1992).

The philosophy behind IWDM is to implement effective management techniques in a cost-effective manner while minimizing the potentially harmful effects to humans, target and non-target species, and the environment. IWDM draws from the largest possible array of options to create a combination of techniques for the specific situation. IWDM may incorporate cultural practices, habitat modification, animal behavior modification, removal of individual animals, local population reduction, or any combination of these methods depending on the characteristics of the specific damage problem.

3.2.2 Integrated Beaver, Nutria, or Muskrat Damage Management Strategies used by WS

Technical Assistance Recommendations (management decision and implementation is the responsibility of the requester). WS personnel provide information, instructional sessions, demonstrations, and advice on available beaver, nutria, and muskrat damage management techniques. Technical assistance includes demonstrations on the proper use of damage reduction devices (body-grip traps, leg-hold traps, tree guards, etc.) and information on water control devices, wildlife habits and biology, habitat management, and animal behavior modification. Technical assistance is generally provided following an on-site visit or verbal consultation with the requester. Bulletins and leaflets on beaver, nutria, and muskrat biology could be sent to requesters to inform them about aesthetic values of aquatic furbearers, types of damage, and damage management methods. Generally, several management strategies are described to the requester for short and long-term solutions to damage problems. These strategies are based on factors such as need and practical application. Technical assistance may require substantial effort by WS personnel in the decision making process, but the actual damage reduction work is the responsibility of the requester.

Operational Damage Management Assistance (management conducted or supervised by WS personnel). Operational damage management assistance is implemented when the problem cannot be resolved through technical assistance and when Cooperative Agreements provide for WS operational assistance. The initial investigation explores and defines the nature and history of the problem, extent of damage, and the species responsible for the damage. Professional skills of WS personnel are often required to resolve problems effectively and safely, especially if restricted pesticides are required or if the problem is sufficiently complex to require the direct involvement of a wildlife professional. WS considers the biology and behavior of the damaging species, and other factors using the WS Decision Model (Slate et al. 1992). The recommended

strategy(ies) may include any combination of preventive actions, generally implemented by the landowner/manager, and corrective actions, generally implemented by WS. Corrective damage management is applying management techniques to stop or reduce current losses. As requested and appropriate, WS personnel may provide information on non-lethal and lethal techniques, conduct demonstrations, or take action to prevent additional losses from occurring.

Education. Education is an important element of WS program activities, because wildlife damage management is about finding "balance" or co-existence between the needs of people and wildlife. This is extremely challenging as nature has no balance, but rather, is in continual flux. In addition to the routine dissemination of recommendations and information to individuals or organizations sustaining damage, lectures and demonstrations are provided to farmers, homeowners, and other interested groups. WS frequently cooperates with other agencies in education and public information efforts. Additionally, technical papers are presented at professional meetings and conferences so that WS personnel, other wildlife professionals, and the public are updated on recent developments in damage management technology, laws and regulations, and agency policies. WS provides informational leaflets about beaver, nutria, and muskrat damage management, biology, and ecology. The Missouri WS program annually provides hundreds of beaver, nutria, and muskrat leaflets and handouts to the public about ARDM. This information is disseminated by means of school programs, exhibits, and calls from requesters.

3.2.3 The WS Decision Model

The procedures used by WS personnel to determine management strategies or methods applied to specific damage problems can be found in USDA (1997). Additionally, the WS Decision Model (Figure 3.1) considers the following factors before selecting or recommending damage management methods and techniques:

- Species responsible for the damage,
- Magnitude, geographic extent, frequency, historical damage, and duration of the problem,
- Status of target and non-target species, including T&E species,
- Local environmental conditions,
- Potential biological, physical, economic, and social impacts,
- Potential legal restrictions, and
- Costs of damage management options.

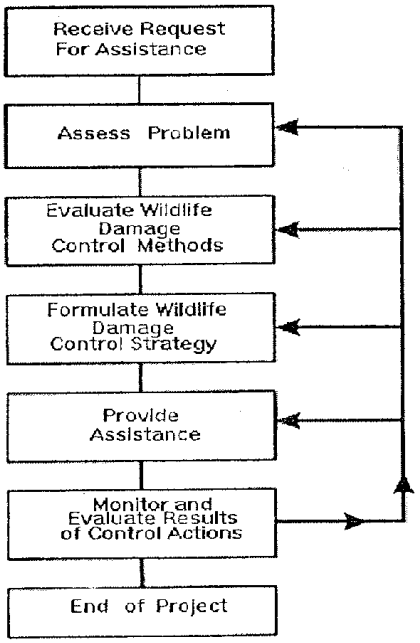

Figure 3.1 WS Decision Model as presented by Slate et al. (1992) for developing a strategy to respond to a request for assistance with human-wildlife conflict.

The decision making process is a procedure for evaluating and responding to damage complaints. WS personnel are frequently contacted after requesters have tried non-lethal techniques and found them to be inadequate for reducing damage to an acceptable level. WS personnel assess the problem, evaluate different methods for availability (legal and administrative), and base biological, economic, and social considerations on suitability. Following this evaluation, methods deemed to be practical for the situations are formed into a management strategy. After the management strategy has been implemented, monitoring and evaluation of the strategy is conducted to assess effectiveness of the strategy. If the strategy is effective, the present need for management is ended. When damage continues intermittently over time, WS personnel and the requester monitor and re-evaluate the situation. If one method or a combination of methods fails to stop damage, a different strategy is implemented. In terms of the WS Decision Model (Slate et al. 1992), most damage management efforts consist of a continuous feedback loop between receiving the request and monitoring the results, with the damage management strategy re-evaluated and revised periodically if necessary. The Decision Model is not a documented process, but a mental problem-solving process common to most, if not all, professions.

3.2.4 Local Decision Making Process

WS provides technical assistance to the requester regarding the biology and ecology of beaver, nutria, and muskrats and effective, practical, and reasonable methods to reduce wildlife damage. Technical assistance includes instructions on non-lethal and lethal

methods. WS and other state and federal wildlife or wildlife damage management agencies may facilitate discussions at local community meetings when resources are available, and make recommendations. In Missouri resource owners and others directly affected by beaver, nutria, or muskrat damage or conflicts have direct input into the resolution of such problems. Requesters may implement management recommendations provided by WS or others on their own, or request management assistance from WS, other wildlife management agencies, local animal control agencies, or private businesses or organizations.

Local decision makers have the final decision on which available (legally and administratively) methods would be used to solve a human-wildlife conflict. Decision makers also may compare the benefits versus the damage when deciding which methods would be implemented including weighing the cost of implementing each methodology or a series of methodologies. Community leaders, private property owners/managers, and public property owners/managers are often the local decision makers.

3.3 BEAVER, NUTRIA, OR MUSKRAT DAMAGE MANAGEMENT METHODS AUTHORIZED FOR USE OR RECOMMENDED BY WS

USDA (1997) describes methods currently used by WS. Several of these were considered in this EA because of their potential use in reducing beaver, nutria, and muskrat damage to roads, bridges, railroads, property, natural and agricultural resources, and public health and safety. A listing and more detailed description of the methods used by Missouri WS for beaver, nutria, and muskrat damage management is found in Appendix D of this EA.

3.3.1 Non-lethal Beaver, Nutria, or Muskrat Damage Management Methods

Habitat Management- Habitat management generally refers to riparian vegetation manipulation to reduce the carrying capacity for beaver, nutria, or muskrats. Habitat management often involves the removal of all woody and aquatic vegetation to eliminate beaver, nutria, and muskrat food sources. However, removal of all food sources would be an extreme and impractical method in most situations with undesirable ecological consequences. Habitat management also may involve manipulating water levels in beaver impoundments to reduce damage or conflict caused by flooding. Water control devices and pond levelers may be installed to regulate the volume of water and can be effective in reducing flooding in certain situations (Minnesota Department of Natural Resources 1994). Water control devices and pond levelers also are utilized as a means of exclusion at road culverts.

Exclusion - Exclusion (tree wraps, fencing, electrical barriers, paint with sand) involves exclusion of beaver, nutria, or muskrats from protected resources or prevention of girdling and gnawing.

Beaver Dam Breaching/Removal - Beaver dam breaching/removal involves the removal of debris deposited by beaver that impedes water flow. Debris would be removed from beaver dams with binary explosives, mechanical equipment, or hand tools.

3.3.2 Techniques for Animal Removal

These methods are specifically designed to remove beaver, nutria, or muskrat in certain situations to a local population level that stabilizes, reduces, or eliminates damage. Amount of removal necessary to achieve a reduction of beaver, nutria, or muskrat damage varies according to the resource protected, habitat, species population, effectiveness of other damage management strategies, and other population factors. Although some of the methods described below can be used to live-capture beaver, for reasons described in Section 3.5.5, all target animals live-captured will be euthanized via gunshot and not relocated.

Leg-hold traps- Leg-hold traps can be effectively used to capture a variety of animals. Generally all leg-holds traps used to capture aquatic rodents are set near adequate water depth and rigged with a drowning mechanism that will immediately dispatch the animal. Effective trap placement, trap adjustment, and selection and placement of appropriate lures contribute to the leg-hold trap's selectivity. All beaver, nutria, and muskrats live captured in leg-hold traps would be euthanized by shooting.

Snares- Snares are live-capture devices consisting of a cable loop and a locking device. Snares are placed in travel ways or areas of high aquatic rodent activity. Snares also are equipped with a swivel to minimize cable twisting and fraying, thus reducing snare breakage. Beaver live-captured in snares would be euthanized by shooting.

Colony traps- Colony traps are multiple catch traps used mainly to capture muskrats. Colony traps are usually set at the entrance of a muskrat den and can be used for kill-trapping or live-trapping muskrats. All muskrats live-captured would be euthanized by shooting.

Hancock traps- Hancock or Bailey traps are designed to live-capture beaver. The trap is constructed of a hinged, metal frame covered with chain-link fence. Large springs cause the trap to close when tripped. Trap appearance is similar to a large suitcase when closed. When set the trap is opened into a flattened position to allow an animal to enter. When the trap is tripped, the sides of the trap close around the animal. All beaver live-captured in Hancock traps would be euthanized by shooting.

Shooting- Shooting is the most selective method for removing target species and may involve the aid of a spotlight. Shooting is conducted with shotguns, rifles, or pistols.

Body-grip traps- Body-grip (e.g., Conibear) traps are designed to cause the quick death of the animal that activates the trap. The appropriate size trap would be used for beaver and nutria (generally 330, 220 Conibear) and are used in aquatic habitats. Body-grip traps are placed at various depths ranging from a few inches to several feet below the

water surface. Smaller body-grip traps (generally 110 Conibear) would be used for muskrats and can be set either in or out of water.

3.3.3 Chemical Management Methods

All chemicals used by Missouri WS are registered under FIFRA, administered by the EPA, and approved by the Food and Drug Administration (FDA) and Missouri Department of Agriculture. No chemicals are used on public or private lands without authorization from the land management agency or property owner/manager. There are currently no chemical methods available for beaver damage management.

Zinc phosphide is the only chemical method currently authorized for use in nutria and muskrat damage management in Missouri WS program. This chemical would be registered with MDA prior to use. Zinc phosphide is used to reduce nutria and muskrat damage by applying the chemical to bait. The maximum application rate is 10 lbs of bait (0.6% active ingredient) per raft placed no closer than 50 feet apart.(EPA Reg. No. 56228-6).

3.4 METHODS CONSIDERED BUT DEEMED IMPRACTICAL, INEFFECTIVE, OR UNSAFE AT THE PRESENT TIME

3.4.1 Harassment Activities

Harassment has generally proven ineffective in reducing beaver or muskrat damage problems (Jackson and Decker 1993). Destroying beaver dams and lodges without removing resident animals rarely resolves damage problems. Beaver usually rebuild dams and lodges in the same vicinity in a very short time. Removal of food supplies to discourage beaver, nutria, or muskrat activity is generally neither feasible nor ecologically desirable.

3.4.2 Repellents

Repellents generally consists of products which are designed to make an animal avoid a food item or area because of an odor, taste or texture. Some repellents cause avoidance by making an animal ill when it eats a treated food item (conditioned aversion). No effective repellents are registered for beaver, nutria, or muskrat damage management.

3.4.3 Reproduction Control

A review of research evaluating chemically induced and surgically induced reproductive inhibition as a method for controlling nuisance beaver populations is contained in Novak (1987a). Although these methods were effective in reducing beaver reproduction by up to 50%, methods were not practical or too expensive for large-scale application. Additionally, reproductive control does not alleviate current damage problems (Organ et al. 1996).

Reproduction control methods involve the use of chemicals or surgical procedures to inhibit reproduction of beaver, nutria, and muskrats, thus reducing population levels. Chemical reproductive inhibitors can be classified into one of three types: chemosterilants, immunocontraceptives, and temporary, short term contraceptives. Several reproductive inhibitors have been proposed for use in beaver population reduction, including quinestrol (17-alpha-ethynyl-estradiol-3-cyclopentylether) and mestranol (Gordon and Arner 1976, Wesley 1978). Chemosterilants have been suggested as a means to manage beaver populations (Davis 1961, Arner 1964). However, while chemosterilants have been shown to reduce beaver reproduction in controlled experiments, no practical and effective method for distributing chemosterilants in a consistent way to wild, free ranging beaver populations has been developed or proven (Hill et al. 1977, Wesley 1978). No chemical reproductive inhibitors are currently registered for use on beaver, nutria, or muskrat damage management in the United States.

As with chemical repellents and toxicants, a reproduction inhibitor could potentially affect non-target wildlife and the environment. Any inhibitor would have to be tested intensively and approved for use. Inhibition of reproduction also may affect behavior, physiological mechanisms, and colony integrity (Brooks et al. 1980). Additional research is needed to test the environmental effects, effects to overall populations, and effects to individual animals. If a technique or chemical becomes registered for use, WS could incorporate it into ARDM in Missouri.

Currently, no chemical reproductive inhibitors are legal for use for species covered by this EA. For these reasons, this method will not be considered further by Missouri WS.

3.5 ALTERNATIVES NOT CONSIDERED IN DETAIL, WITH RATIONALE

3.5.1 Eradication and Suppression

An eradication and suppression alternative would direct all Missouri WS beaver, nutria, and muskrat damage management efforts toward planned, total elimination or suppression of these species.

Eradication of nutria is a method that would be consider and back by MDC and Missouri WS since nutria are a non-native species to Missouri and their invasive nature can be detrimental to native wildlife populations. However since funding for an operation of this magnitude would be next t o impossible to receive, Missouri WS and MDC do not consider it a viable method of control. Eradication of beaver or muskrats in Missouri is not supported by Missouri WS or MDC. This alternative was not considered in detail because:

- Missouri WS opposes eradication of any native wildlife species,
- MDC opposes eradication of any native Missouri wildlife species,
- Eradication of a native species would be extremely difficult if not impossible to accomplish, and cost prohibitive, and
- Eradication of native species is not acceptable to most members of the public.

Suppression would direct Missouri WS program efforts and resources toward managed reduction of certain problem wildlife populations. WS only conducts damage management in response to specific damage sites and makes every effort to only target depredating animals. To consider large-scale population suppression of native species as a goal of the Missouri WS program is not realistic, practical, or appropriate for resolving specific damage problems.

Eradication of nutria is an alternative that could be supported by MDC and Missouri WS because nutria are a non-native species and can be detrimental to native wildlife populations and ecosystems. However since funding for an operation of this magnitude would be next to impossible to obtain, Missouri WS and MDC do not consider this to be a viable alternative.

3.5.2 Population Stabilization through Birth Control

Under this alternative, beaver, nutria, and muskrat populations would be managed through use of contraceptives. Beaver, nutria, or muskrats would be sterilized or administered contraceptives to limit reproduction. Beaver, nutria, or muskrat contraceptives, chemosterilants, or immunocontraceptives, if delivered to a sufficient number of individuals, could temporarily suppress local breeding populations by inhibiting reproduction. Reduction of local populations would result from natural mortality combined with reduced fecundity. No beaver, nutria, or muskrats would be killed directly with this method; however, treated beaver, nutria, and muskrats would continue to cause damage. Dispersing beaver, nutria, and muskrat populations would probably be unaffected. However, chemical or biological contraceptive agents for beaver, nutria or muskrats do not exist.

Contraceptive measures for mammals can be grouped into four categories: surgical sterilization, oral contraception, hormone implantation, and immunocontraception (the use of contraceptive vaccines). These measures would require beaver, nutria, or muskrats to receive either single, multiple, or possibly daily treatment to successfully prevent conception. Use of this method would be subject to approval by federal and state agencies. This alternative was not considered in detail because:

- Number of years of implementation before beaver, nutria, or muskrat populations would decline would be large; therefore, damage would continue at the present unacceptable levels for a number of years,
- Surgical sterilization would have to be conducted by licensed veterinarians; therefore, costs would be extremely expensive,
- Live-trapping and chemically treating an effective number of beaver, nutria, or muskrats would be extremely difficult in order to produce an eventual decline in the population, and
- No chemical or biological agents for beaver, nutria, or muskrat contraception have been approved for use by state and federal regulatory authorities.

Since no effective or legal methods of delivering contraceptives to beaver, nutria, or muskrats exist at this time, use of contraceptives is not a realistic alternative.

3.5.3 Compensation for Wildlife Damage Losses

The compensation alternative would direct all Missouri WS program efforts and resources toward the verification of losses from beaver, nutria, and muskrats, and to provide monetary compensation for the losses. Missouri WS activities would not include any operational damage management or technical assistance.

This alternative was analyzed in the Programmatic EIS for WS. Analysis of this alternative in USDA (1997) shows that it has the following drawbacks:

- Compensation would not be practical for public health and safety problems,
- Larger expenditures of money to investigate and validate all losses, and determine and administer appropriate compensation would be required,
- Timely responses to all requests to assess and confirm losses would be difficult, and many losses could not be verified,
- Compensation would give little incentive to limit losses through other management strategies,
- Not all resource managers/owners would rely completely on a compensation program; therefore, unregulated lethal control would probably continue and escalate, and
- Neither Congress nor the State of Missouri has appropriated funds for a compensation program.

3.5.4 Bounties

Bounties can be defined as payments of funds for killing beaver, nutria, or muskrats. Currently, no statewide bounties exist for aquatic rodents in Missouri.

Payment of funds for killing beaver, nutria, or muskrats (bounties) suspected of causing economic loss is not supported by WS, and Missouri WS does not have authority to establish a bounty program. Bounties are not considered because:

- Bounties are generally not effective in managing wildlife or reducing damage,
- Circumstances surrounding take of animals is largely unregulated, and
- No process exists to prohibit taking of animals from outside the damage management area for compensation purposes.

3.5.5 Live-trap and Relocate

Currently in Missouri, the MDC authorizes a landowner or their agent to capture and remove problem animals. Relocation is only authorized by a MDC Conservation agent.

Relocation of problem wildlife species is a technique occasionally used to alleviate wildlife damage problems. However, success of relocation efforts depends on the potential for problem individuals to be captured efficiently and existence of an appropriate relocation site (Nielsen 1988). Relocation may be appropriate in some situations when the population is low. However, aquatic rodents are abundant in much of the suitable habitat in Missouri, and relocation is not necessary for the maintenance of viable populations. Because beaver are abundant in Missouri, beaver relocated into suitable habitat are very likely to encounter other beaver with established territories. Beaver are highly territorial, and newly introduced beaver, which are disoriented and at a disadvantage, are often attacked viciously and oftentimes killed from these encounters (McNeely 1995). Survival of relocated animals is generally very poor due to stress of relocation, and in many cases released animals suffer mortality in a new environment (Craven 1992). Courcelles and Nault (1983) found that 50% (n=10) of radio-collared, relocated beaver died, probably from stress or predation resulting from the relocation.

Relocated beaver also may disperse long distances from the release site (Novak 1987*a*). Hibbard (1958) recorded an average dispersal distance by 17 relocated beaver to be approximately 9 miles in North Dakota, and Denney (1952) reported an average dispersal of 10.4 miles and a maximum dispersal of 30 miles for 26 transplanted beaver in Colorado. Beaver relocated on streams and later recaptured (n=200) moved an average distance of 4.6 miles, and in lake and pothole relocations (n=272) moved an average of 2 miles (Knudsen and Hale 1965). Only 12% of beaver relocated on streams and 33% of beaver relocated on lake and pothole areas remained at the release site (Knudsen and Hale 1965).

Relocation of aquatic rodents causing damage could result in similar damage problems at the release site or dispersal site. In this case, the original damage problem has simply been shifted from one property to another. If Missouri WS relocated a problem animal, Missouri WS could possibly be held liable for any subsequent damage caused by that animal. Relocating nutria, a non-native species, would only exacerbate and spread the problem with nutria in the state.

Live-trapping and relocating aquatic rodents is biologically unsound and not cost-efficient (Wade and Ramsey 1986). The AVMA, the National Association of State Public Health Veterinarians, and the Council of State and Territorial Epidemiologists oppose the relocation of mammals because of disease transmission risks, particularly for small mammals (Center for Disease Control 1990). Animal advocacy groups appear to be in disagreement about relocating wildlife to alleviate damage. PETA opposes relocation of problem beaver, because they believe relocation is cruel (Redmon 1999, 2000). The HSUS believes relocation is preferable to death in some circumstances, but point out that relocation could be stressful and result in suffering or death (Bridgeland et al. 1997). The HSUS openly advocates relocating muskrats to alleviate damage, but is less clear about beaver (Bridgeland et al. 1991).

For the above stated reasons, Missouri WS does not support the relocation of aquatic rodents for damage management and will not relocate aquatic rodents within Missouri.

3.5.6 Live-capture and Euthanasia Only

Live-capture and euthanasia of beaver, nutria, and muskrats may be used as part of the IWDM approach to reduce aquatic rodent damage. Snares would be used to live-capture beaver. While snares are an effective and at times an efficient tool for capturing beaver, use of additional methods (e.g. body-grip traps, shooting, leg-hold traps) could be necessary to reduce damage in a cost-effective manner. Snares are inappropriate to use in moving water because the current closes or disables the snare. Nutria and muskrats could be live-captured in floating colony traps, but these traps are cumbersome and require more time to set than body-grip traps, leg-hold traps, and standard colony traps.

3.6 MITIGATION IN STANDARD OPERATING PROCEDURES FOR BEAVER, NUTRIA, AND MUSKRAT DAMAGE MANAGEMENT

Mitigation is any feature of an action that serves to prevent, reduce, or compensate for impacts that otherwise might result from that action. The current WS program, nationwide and in Missouri, incorporates mitigations in its standard operating procedures (Table 3.1). Mitigations are discussed in detail in Chapter 5 of USDA (1997).

Table 3.1 Mitigation in standard operating procedures for beaver, nutria, or muskrat damage management in Missouri.

Standard Operating Procedures	**Alternatives**[1]				
	1	2	3	4	5
Animal Welfare and Humaneness of Methods Used by WS					
Research on selectivity and humaneness of management practices would be monitored and adopted as appropriate.		X	X	X	X
The Decision Model (Slate et al. 1992) would be used to identify effective biologically and ecologically sound beaver, nutria, and muskrat damage management strategies and their impacts.		X	X	X	X
Captured non-target animals would be released unless it is determined by Missouri WS personnel that the animal would not survive.		X	X		X
Use of traps and snares would conform to current laws and regulations administered by MDC and Missouri WS policy.		X	X		
Where practical, euthanasia procedures approved by the AVMA that cause minimal pain would be used for live animals.		X	X		
Use of newly-developed, proven, non-lethal methods would be encouraged when appropriate.			X	X	X
Safety Concerns Regarding WS ARDM Methods					
All pesticides that are used by WS would be registered with the EPA.		X	X		
EPA-approved label directions would be followed by WS employees.		X	X		
The Decision Model (Slate et al. 1992), designed to identify the most appropriate damage management strategies and their impacts, would be used to determine beaver, nutria, and muskrat damage management strategies.		X	X	X	X
Beaver, nutria, and muskrat damage management conducted on public lands would be coordinated with the management agency.		X	X		X
WS employees that use pesticides would be trained to use each material and would be certified to use pesticides under EPA approved certification programs.		X	X		
WS employees who use pesticides would participate in approved continuing education to keep abreast of developments and maintain their certifications.		X	X		
Live-traps would be placed so that captured animals would not be readily visible from any road or public area.		X	X		X
Pesticide use, storage, and disposal conform to label instructions and other applicable laws and regulations, and Executive Order 12898.		X	X		
Material Safety Data Sheets for pesticides would be provided to all WS personnel involved with specific damage management activities.		X	X		

Standard Operating Procedures	Alternatives[1]				
	1	2	3	4	5
Concerns about Impacts of Damage Management on Target Species, T&E Species, Species of Special Concern, and Non-target Species.					
WS consulted with the USFWS regarding the nation-wide program and the MO program and would continue to implement all applicable measures identified by the USFWS to ensure protection of T&E species.		X	X		X
Missouri WS take would be considered with the statewide "total harvest" (Missouri WS take and fur harvest) when estimating the impact on wildlife species.		X	X		
Management actions would be directed toward localized populations or groups and/or individual offending animals, dependent on the magnitude of the problem.		X	X		X
WS personnel would be trained and experienced to select the most appropriate method for taking targeted animals and excluding non-target species.		X	X		X
When Zinc Phosphide is used over water, treated bait will be confined in such a manner to prevent treated from falling into the water and access to the bait station by passerines and waterfowl.		X	X		
Zinc Phosphide will not be used in areas where T&E listed aquatic species (mussels and fish) are known to occur.		X	X		
WS would initiate informal consultation with the USFWS following any incidental take of T&E species.		X	X		X

[1] Alternative 1 No WS Beaver, Nutria, or Muskrat Damage Management in Missouri
Alternative 2 Only Lethal Beaver, Nutria, and Muskrat Damage Management
Alternative 3 Fully Integrated Beaver, Nutria, and Muskrat Damage Management for all Public and Private Land (No Action/Proposed Action)
Alternative 4 Technical Assistance Only
Alternative 5 Non-Lethal Beaver, Nutria, and Muskrat Damage Management

CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

4.0 INTRODUCTION

Chapter 4 provides information for making informed decisions about alternatives for addressing the beaver, nutria, and muskrat damage described in Chapter 1. This chapter consists of: 1) a general discussion of the analysis of environmental consequences, 2) analysis of each alternative against the issues considered in detail described in Chapter 2, and 3) summary of WS impacts.

4.1 ENVIRONMENTAL CONSEQUENCES

This section analyzes the environmental impacts of each alternative using Alternative 3 (the current program) as the baseline (no action) when comparing the other alternatives to determine if real or potential impacts are greater, lesser, or the same (Table 4.3). The No Action Alternative, as defined here, is consistent with the CEQ guidance (CEQ 1981). In this guidance, the No Action alternative for situations where there is an ongoing management program may be interpreted as "no change" from current management direction or level of management intensity. Alternative 1 is the analysis of impacts associated with no WS involvement in ARDM.

It should be noted that landowners/managers in Missouri have the right to handle aquatic rodent damage on their own or to obtain the assistance of a designated agent (e.g. recreational trappers, private or public specialists) without involvement by WS. Therefore, a major overarching factor in determining the potential environmental impacts of WS's involvement in ARDM, is that such management will apparently be conducted by state, local government, or private entities that are not subject to compliance with NEPA if WS is not involved. WS does not have the authority to manage the landowners/ managers ability to try and reduce wildlife damage problems on their own.

The following resource values within Missouri would not be adversely impacted by any of the alternatives analyzed: soils, geology, minerals, flood plains, visual resources, air quality, prime and unique farmlands, aquatic resources, timber, and range. These resources will not be analyzed further.

4.1.1 Social and Recreational Concerns

Social and recreational concerns are discussed throughout the document as they relate to issues raised during public involvement. Additionally, they are discussed in the WS programmatic FEIS (USDA 1997 Revised).

4.1.2 Cumulative and Unavoidable Impacts

Impacts that are cumulative and unavoidable are discussed in relationship to each environmental impacts analyzed in this chapter. This EA defines the total annual removal of individual animals from wildlife populations from all sources as cumulative mortality. Analysis of Missouri WS take during 2000-2003 and anticipated future WS take, in combination with other mortality, indicates that cumulative impacts are not

adversely affecting the viability and health of wildlife populations. It is not anticipated that the Missouri WS program would result in any adverse cumulative impacts to T&E species, and beaver, nutria, and muskrat damage management activities do not jeopardize public health and safety.

4.1.3 Irreversible and Irretrievable Commitments of Resources

Other than minor uses of fuels for motor vehicles and electrical energy for office maintenance, no irreversible or irretrievable commitments of resources are apparent. Based on these estimates, the Missouri WS program produces very negligible impacts on the supply of fossil fuels and electrical energy.

4.2 ISSUES ANALYZED IN DETAIL

4.2.1 Alternative 1. No WS Beaver, Nutria, or Muskrat Damage Management in Missouri

Effects on beaver, nutria, and muskrat populations- WS would have no impact on beaver, nutria, and muskrat populations in Missouri. Impacts to beaver, nutria, and muskrat would be variable dependent upon actions taken by affected landowners/resource managers. Landowners/resource managers would receive no guidance from WS regarding their options, but it is likely that most resource managers would continue to attempt to do something about their aquatic rodent damage. Some landowners/resource managers experiencing damage would trap or shoot beaver, nutria, and muskrats themselves, or hire private trappers to conduct the work. If lethal techniques are used, this alternative would result in short-term, localized decreases in target species populations at damage management sites. Some resource managers experiencing damage may take illegal or unsafe action against local populations of beaver, nutria, and muskrats either unintentionally due to lack of training, or deliberately out of frustration of continued damage. In these instances, more target species may be taken than with a professional WDM program (Alternatives 2&3) or in situations where technical assistance and or non-lethal alternatives are readily available (Alternatives 3-5). Therefore, depending upon the actions taken by resource managers, overall impacts of this alternative on target species populations may be similar to Alternative 2 and similar to or slightly higher than Alternatives 3-5.

Effects on plants and other wildlife species, including T&E species- In the absence of WS assistance, some landowners/resource managers may attempt to trap beaver, nutria, or muskrats or hire private trappers with variable degrees of damage management experience. Depending upon their training, these resource managers or trappers could be more likely than WS personnel to trap non-target species and might not report non-target take to regulatory authorities. Other resource managers experiencing damage may take illegal or unsafe action against local populations of beaver, nutria, and muskrats out of frustration with continued damage resulting in elevated risks to plant and wildlife populations.

One anticipated outcome of no WS beaver damage management is a likely increase in beaver, nutria, and muskrat damage and associated beaver created impoundments if resource owners do not remove beaver dams. As discussed in Sections 1.4 and 1.5 beaver impoundments have an impact on other wildlife and plant species. Extent and nature of the impacts would depend upon the size of the beaver created impoundment, the length of time the impoundment had been present and diversity of plant and animal species in the area. Some species would flourish in the newly created environment, while others would diminish. Since most problems with beaver dams are identified shortly after the dam is created, prompt dam removal by will result in return of the habitat to initial conditions and a low overall impact on plants and wildlife.

Aquatic rodent feeding damage to native plant species may increase under this alternative unless affected resource owners implement their own aquatic rodent damage management plan.

Effects on public and pet health and safety - If resource owners do not implement an effective beaver, nutria, and muskrat damage management program in the absence of WS, potential for increased risks to public health and safety from unresolved damage situations is apparent. For example, burrowing into or flooding of roadways and railroad beds can result in serious accidents (Woodward 1983, Miller and Yarrow 1994). Beaver also are carriers of the intestinal parasite *Giardia lamblia*, which can contaminate water supplies and cause outbreaks of the disease Giardiasis in humans (Woodward 1983, Wade and Ramsey 1986, Miller and Yarrow 1994).

Additionally, resource owners inexperienced in the safe and proper use of management tools may attempt to resolve beaver, nutria, and muskrat damage problems. Without professional assistance or proper training in the use of damage management tools there will be increased risks to public and pet safety. Increased risks are associated with the improper or inexperienced use of damage management methods such as trapping, shooting, and dam removal with explosives.

Humaneness of methods to be used - Individuals concerned about government involvement in actions they consider inhumane would find this alternative more acceptable than Alternatives 2 and 3, and possibly Alternatives 5 depending upon individual perceptions of non-lethal ARDM techniques. However, the overall humaneness of the alternative is not likely to be substantially different than Alternatives 2 and 3 because landowners/resource managers could use lethal and non-lethal methods to reduce beaver, nutria, and muskrat damage in the absence of WS. Impacts on humaneness would depend on the experience of the person implementing the control method. Use of capture devices by inexperienced personnel may lead to increased pain and suffering by target and non-target animals. Some resource/property owners may take illegal action against localized populations of beaver, nutria, or muskrats out of frustration with continued damage. Illegal actions may be less humane than methods used by experienced WS personnel.

Effects on wetlands - WS would have no impact on wetlands. Under this alternative, beaver dam breaching and removal needs would be met by private, state, or local government entities. Some beaver impounded areas that WS would advise against draining might be drained under private or local government management, which could have adverse effects on wetland habitats in limited circumstances.

Economic losses to property - Beaver, nutria, and muskrat damage would likely continue to increase unless an effective damage management program was implemented by non-WS personnel. Depending upon the level of experience and methods available to non-WS personnel conducting the damage management, the ARDM program may be less efficient and effective than a WS program thereby increasing costs to the landowner/resource manager.

Impact to stakeholders, including aesthetics - Impacts of this alternative to stakeholders would be variable depending on their values regarding wildlife. Landowners/resource managers with damage from beaver, nutria, or muskrats would likely strongly oppose this alternative and likely perceive it as an unjust restriction on their right to assistance with problems caused by the public's wildlife. Individuals opposed to government involvement in ARDM, especially the use of lethal management tools, would prefer this alternative.

Some people would support this alternative because they feel that their opportunity to enjoy seeing beaver, nutria, or muskrats would not be adversely impacted by WS. However, while WS would take no action under this alternative, other individuals or entities could, and likely would, conduct damage management activities resulting in impacts similar to Alternative 3. The ability to view and esthetically enjoy beaver, nutria, or muskrats at a particular site could be limited if the beaver, nutria, or muskrats are removed. However, new animals would most likely re-colonize the site in the future. The length of time until new beaver, nutria, or muskrats arrive is variable. Re-colonization depends on habitat type and quality, time of year, and population densities of beaver, nutria, and muskrats in surrounding areas. As discussed above, there would be no reduction in the overall aquatic rodent population in Missouri, so opportunities to view beaver, nutria, or muskrats would be available to individuals visiting sites with adequate habitat outside of the damage management area.

4.2.2 Alternative 2. Only Lethal Beaver, Nutria, and Muskrat Damage Management

Effects on beaver, nutria, and muskrat populations - This alternative could result in a localized decrease in the beaver, nutria, or muskrat populations at the specific site where the damage management occurs. As with Alternative 1, it is possible, that in the absence of readily available information on non-lethal techniques from WS, more resource managers would use lethal techniques to address their aquatic rodent problems. Therefore the number of aquatic rodents killed by WS under this alternative may be slightly higher than for Alternative 3. However, the number of aquatic rodents killed under this Alternative is still not anticipated to exceed 1,500 beaver, 500 nutria, and

3,000 muskrats annually. New beaver, nutria, or muskrats would likely immigrate to sites where animals had been removed. Amount of time until new beaver, nutria, or muskrats move into the area would vary depending on habitat type and quality, time of year, and population densities in the surrounding area. In our experience in Missouri, most areas are re-colonized by beaver in 3-12 months.

Effects on plants and other wildlife species, including T&E species - Non-target species such as otter, mink, raccoons, and turtles may occasionally be killed during beaver, nutria, or muskrat damage management. WS impacts on non-target species from capture methods would be similar to or slightly higher than those described in Alternative 3 because of the potential for greater use of lethal management techniques.

Removal of beaver, nutria, and muskrats may reduce gnawing and feeding on certain plants and mussels. Reduction in aquatic rodent damage to native plant species would be similar to Alternative 3 when lethal methods are effective in reducing such damage. WS would not remove or breach beaver dams under this alternative. Impacts related to beaver dam breaching or removal on native plants and animals would be similar to Alternative 1.

WS would use the same measures for the protection of T&E species described for Alternative 3. Therefore, impacts of WS damage management methods on T&E species would be similar to Alternative 3.

Effects on public and pet health and safety - WS impacts on public and pet health and safety resulting from the reduction of aquatic rodent health and safety risks would be similar to those described in Alternative 3, except in those situations where health and safety risks would be reduced by the use of non-lethal methods, such as removal or breaching of beaver dams or installation of water control structures. Since WS would not implement or recommend non-lethal control methods under this alternative, impacts related to non-lethal methods would be similar to Alternative 1. Risks to public and pet health and safety from WS' use of lethal methods would be very low, but could slightly higher than Alternative 3 because of the potential increase in use of lethal management techniques.

Humaneness of methods to be used - WS personnel are experienced and professional in using management methods and tools humanely and effectively. Under this alternative, beaver, nutria, and muskrats would be humanely trapped or shot by experienced WS personnel using the best methods available. Beaver, nutria, and muskrats live-captured in traps or snares would be euthanized by shooting. Some aquatic rodents may be removed through the use of drowning trap sets and registered toxicants. Humaneness issues relative to the use of lethal management techniques will be similar to Alternative 3. However, because of the lack of WS involvement in the use of non-lethal techniques, there may be higher use of lethal management methods. Persons opposed to the use of lethal techniques will be more opposed to this Alternative than to Alternative 3 because of the potential for increased use lethal techniques. Individuals concerned about animal welfare and the need to ensure that animals are not killed or do not suffer needlessly will

also likely be opposed to this alternative because WS will not be providing information on non-lethal methods for solving damage problems or preventing new problems.

Effects on wetlands - Under this alternative, WS would remove beaver, nutria, and muskrats from a site; however, WS would not remove or breach beaver dams. Therefore, effects on wetlands from dam removal and breeching activities would be similar to Alternative 1.

Economic losses to property - Damage to property would be expected to decrease as beaver, nutria, and muskrats are lethally removed from the site. Damage to property is expected to continue or increase in those situations where non-lethal methods, such as dam removal, would be necessary to reduce damage. In this case, damage would remain at unacceptable levels unless non-lethal methods are implemented by non-WS personnel.

Impacts to stakeholders, including aesthetics - Impacts of this alternative would be variable depending on each stake holders values and compassion toward wildlife. This alternative would likely be favored by landowners/resource managers with damage if lethal methods reduced damage to acceptable levels. Some landowners/resource managers would be saddened if beaver, nutria, or muskrats were removed. Other landowner/resource managers are likely to oppose restrictions to their access to the full range of management methods from WS, especially non-lethal techniques which are generally perceived as being more humane and which often serve to prevent new problems or extend the time between damage occurrences. Some individuals will oppose this alternative because of a strong moral belief that killing or using animals for any reason is wrong. Other individuals will believe that the benefits from beaver, nutria, and muskrats would outweigh the associated damage and that resource managers should learn to live with the damage.

The ability to view and esthetically enjoy beaver, nutria, or muskrats at a particular site could be limited if the beaver, nutria, or muskrats are removed. However, new animals would most likely re-colonize the site in the future. The length of time until new beaver, nutria, or muskrats arrive is variable. Re-colonization depends on habitat type and quality, time of year, and population densities of beaver, nutria, and muskrats in surrounding areas. There would be no reduction in the overall aquatic rodent population in Missouri (Section 4.2.3), so opportunities to view beaver, nutria, or muskrats would be available to individuals visiting sites with adequate habitat outside of the damage management area.

4.2.3 Alternative 3. Fully Integrated Beaver, Nutria, and Muskrat Damage Management for all Public and Private Land (No Action/Proposed Action)

Effects on beaver, nutria, and muskrat populations - Missouri WS program removes a relatively small number of beaver, nutria, and muskrats from the statewide population in Missouri (Table 4.1). Unlike Alternative 2, the use of exclusion, habitat modification, beaver dam breaching and removal, and water control devices could be used as part of an IWDM approach. Use of non-lethal methods would have little or no direct effect on

aquatic rodent populations, but may decrease the need for lethal methods thereby reducing the number of animals taken with lethal control.

Use of lethal methods may result in short-term local reductions in the density of aquatic rodents. The amount of time until new beaver, nutria, or muskrats move into the area would vary depending on habitat type and quality, time of year, and population densities in surrounding areas. From our experience in Missouri, most areas can be re-colonized by beaver in 3-12 months.

The MDC has authority for management of resident wildlife species. Beaver and muskrats are classified as furbearers which have a regulated harvest season. MDC classifies nutria as an invasive species and does not regulate harvest. MDC compiles and provides information on population trends and take, and uses this information to manage beaver and muskrat populations. Therefore, by working with the MDC, WS uses the best information available to generate population estimates for beaver and muskrats in Missouri.

Table 4.1 Beaver, nutria, and muskrats harvested by licensed fur trappers and taken by WS (target and non-target combined) for wildlife damage management in Missouri, 2000-2003[1].

	2000	2001	2002	2003	Estimate Maximu Annual Tal
# Beaver removed by WS	5	75	247	183	1,500
# Beaver harvested by licensed trappers[3]	6,349	5,656	7,590	8,135	8,135
Total Harvest of Beaver In Missouri	6,354	5,731	7,837	8,318	9,635
% WS Take of Total Beaver Harvest	0.08	1.3	3.2	2.2	15.7
Estimated Missouri Beaver Population	77,967	77,967	77,967	77,967	77,967
% of State Beaver Population Harvested by All Sources	8.1	7.4	10.1	10.7	12.3
# Muskrat removed by WS	637	624	467	259	3,000
Total Harvest of Muskrat by licensed trappers[3]	7,722	5,225	10,293	13,217	13,217
Total Harvest of Muskrat	8,359	5,846	10,753	13,474	16,217
% WS Take of Total Muskrat Harvest	7.6	10.7	4.3	1.9	22.7
Estimated Missouri Muskrat Population	1,300,000	1,300,000	1,300,000	1,300,000	1,300,000
% of State Muskrat Population Harvested by All Sources	0.6	0.4	0.8	1.0	1.2
# Nutria removed by WS	n/a	n/a	4[4]	1[4]	500
Total Harvest of Nutria by licensed trappers	n/a	n/a	n/a	n/a	n/a
Total Harvest of Nutria	n/a	n/a	n/a	n/a	n/a
Estimated Nutria Population	n/a	n/a	n/a	n/a	n/a

[1] Year indicates the federal fiscal year (October 1 thru September 30) and the Missouri trapping season (November to January).
[2] Calculated using maximum WS take under a worst-case scenario and maximum recreational harvest from the period of 2000-2003.
[3] Data are from MDC.
[4] Nutria taken were non-target animals taken during projects to manage beaver damage.

Beaver Population Information and Impact Analysis- Beaver are usually found in family groups that are comprised of 2 adult parents with 2-6 offspring from the current or previous breeding season (Novak 1987a). Average family group size has been documented as ranging from 3.0 to 9.2 beaver (Novak 1987a). Beaver abundance has been reported in terms of families/kilometer of stream or families/square kilometer of habitat. Novak (1987a) summarized reported beaver family abundance as ranging from

0.31 to 1.5 families/kilometer of stream, which converts to 0.5 – 2.4 families/mile of stream. Densities reported in terms of families/square kilometer have been reported to range from 0.15 to 3.9 (Novak 1987a) which is the same as 0.24 to 6.3 families/square mile. Additionally, Novak (1987a) indicates population growth rates of beaver are density dependent, which means rates of population growth generally increase as a population is reduced and decrease as a population reaches carrying capacity[1]. This is a natural function of most wildlife populations which helps to naturally mitigate population reductions. Logan et al. (1996) indicated that wildlife populations being held at a level below carrying capacity can sustain a higher level of harvest because of the compensatory mechanisms that cause higher rates of increase in such populations.

No population estimates were available for beaver in Missouri. Therefore the best available information was used to estimate the statewide population. There are over 643,000 acres of freshwater wetlands in Missouri (http://www.nwi.fws.gov/bha/) including an estimated minimum of 51,978 miles of streams (USEPA 1998). Using the conservative estimate of 3 beavers per family group and an abundance of 0.5 families per stream mile provided by Novak et al. (1987a), the minimum statewide beaver population estimate for Missouri could be estimated at 77,967 beavers.

Number of beaver taken by WS and fur trappers is shown in Table 4.1. The FY 02 lethal take of 247 beavers was the highest number ever removed by the Missouri WS program in one year and the second highest number of 183 beavers was taken in FY 03. Based upon current activity and anticipated increases in future work, WS expects that not more than 1,500 beaver would be killed annually by WS in Missouri.

The WS programmatic EIS (USDA 1997 Revised) established a 30% sustainable harvest threshold for beaver. Using the estimate of the beaver population from above and the maximum estimated annual cumulative take from Table 4.1, cumulative take of beaver is not anticipated to exceed 13% of the population. Therefore, we conclude that the cumulative take of beaver proposed under this alternative will have a low level of impact the Missouri beaver population. This is consistent with the MDC determination that the statewide beaver population is stable to increasing and there is no evidence to suggest that current cumulative mortality resulting from regulated fur harvest and damage management has been detrimental to the survival of the Missouri beaver population (Dave Hamilton, MDC personal consultation February 3, 2004).

Muskrat Population Information and Impact Analysis - Muskrats are considered abundant in Missouri and are scattered in suitable habitat throughout the State. Muskrats can be found in marshes, ponds, sloughs, lakes, ditches, streams, and rivers (Boutin and Birkenholz 1987). Muskrat home ranges have been shown to vary from 529 sq. ft to 11,970 sq. ft. (0.1 to 0.25 acres) with the size of home ranges occupied by muskrats depending on habitat quality and population density (Boutin and Birkenholz 1987).

[1]Carrying capacity is maximum number of animals the environment can sustain and is determined by food availability, water, cover, and tolerance of crowding by the particular species.

No population estimates were available for muskrat in Missouri. Therefore the best available information was used to estimate statewide populations. There are over 643,000 acres of freshwater wetlands in Missouri (http://www.nwi.fws.gov/bha/) including an estimated minimum of 51,978 miles of streams (USEPA 1998). Using the assumption that 50% of the wetlands support a muskrat population, an average home range of 0.25 acres per muskrat, only 1 muskrat occupies a home range, and no home ranges overlap, a conservative statewide muskrat population could be estimated at over 1.3 million muskrats.

Muskrats are highly prolific and produce 3-4 litters/year and average 5-8 young/litter (Wade and Ramsey 1986) which are characteristics that make them relatively immune to over harvest (Boutin and Birkenholz 1987). Harvest rates of 3-8/acre have been reported to be sustainable in muskrat populations (Boutin and Birkenholz 1987). Trapper harvest during the 2000-2003 regulated trapping seasons (Table 4.1) was compiled by MDC from buyer and dealer transaction records. The FY 00 lethal take of 637 muskrats was the highest number ever removed by the Missouri WS program in one year and the second highest number of 624 muskrats was taken in FY 01. Based upon current activity and anticipated increases in future work, WS expects that not more than 3,000 muskrats would be killed annually by WS in Missouri.

MDC harvest reports indicate that the statewide muskrat population maybe increasing. There is no evidence to suggest that human mediated mortality resulting from regulated fur harvest and damage management will be detrimental to the survival of the muskrat populations in the state of Missouri (Dave Hamilton, Fur bearer Biologist MDC personal consultation February 3, 2004). Current cumulative harvest rates for muskrat, and even the maximum estimated annual cumulative muskrat harvest (Table 4.1) would not exceed 1.5% of the population. Given the high reproductive capacity for muskrat populations, this level of muskrat removal would have a low level of impact on the state muskrat population.

Based upon the above information, MDC oversight, and the low proportion of the population taken by all sources, this alternative would have minimal effects on local or statewide muskrat populations in Missouri.

Nutria Population Information and Impact Analysis - Nutria are a non-native species, and are primarily found in the southeast portion of the state in surface water streams, rivers, reservoirs, wetlands, and marsh habitats. MDC currently considers nutria as an invasive species and does not track harvest of nutria. MDC indicates that the statewide nutria population is increasing. Based upon current and anticipated increases in future work, it is anticipated that not more than 500 nutria would be killed annually by WS in Missouri. Nutria are non-indigenous and often have negative impacts on the environment. Therefore, these animals are considered by many wildlife biologists to be an undesirable component of North American wild and native ecosystems. Any reduction in nutria populations could be considered a beneficial impact to the environment. Although a reduction in the number of introduced nutria may be desirable, the proposed level of nutria control is unlikely to result in more than a temporary

reduction of nutria numbers at specific sites and will not result in a reduction in the overall nutria population in the state of Missouri (Dave Hamilton, MDC personal consultation February 3, 2004).

Effects on plants and other wildlife species, including T&E species - Direct impacts on non-target species would occur if WS program personnel were to inadvertently kill, injure, or harass animals that are not target species. In general, these impacts result from the use of methods that are not completely selective for target species. WS personnel are experienced and trained in wildlife identification, and to select the most appropriate methods for taking targeted animals and excluding non-target species. Shooting is virtually 100% selective for the target species; therefore no adverse impacts on non-target species are anticipated from use of this method. WS personnel select lures and capture equipment and set traps and snares in locations that are most likely to capture target animals while minimizing potential impacts to non-target species. Any non-target species captured unharmed in a live trap would be subsequently released on site. Based on a thorough Risk Assessment, APHIS concluded that, when WS program chemical methods are used in accordance with label directions, they are highly selective to target individuals or populations, and such use has negligible effects on the environment (USDA 1997 Revised). Therefore, no adverse impacts on non-target species from the use of registered pesticides and repellents are anticipated. Mitigation measures designed and implemented to avoid adverse effects on non-target species are described in Chapter 3.

River otters, mink, raccoons and turtles are the non-target species most likely to be taken during aquatic rodent damage management. Non-target species captured during beaver and muskrat control operations are listed in Table 4.2. WS personnel would minimize non-target take with careful trap placement and variation in capture methods. The muskrats and nutria listed in Table 4.2 were taken during beaver damage management activities and were not the intended targets. Take of these animals was included in the total annual take of muskrats and nutria used to determine potential impacts on target species populations.

Table 4.2 – All not target species and their fate taken by MO WS during ARDM activities for FY 00-03

Species	FY 00		FY 01		FY 02		FY 03	
	Killed	Freed	Killed	Freed	Killed	Freed	Killed	Freed
Raccoon	1	1	1	0	12	4	6	6
Muskrat	0	0	1	0	7	0	6	0
Nutria	0	0	0	0	4	0	1	0
River Otter	0	0	2	1	13	0	14	0
Mink	0	0	0	0	2	0	2	0
Fish	1	0	1	0	2	0	0	0
Turtles	0	0	3	1	15	14	14	11
Wood duck	0	0	0	0	1	0	0	0
Canada Goose	0	0	0	0	0	2	0	0
Mallard	0	0	0	0	2	1	1	0
Great Blue Heron	0	0	0	0	1	0	2	0
Green-winged teal	0	0	0	0	0	0	1	0
TOTAL	2	1	8	2	59	21	47	17

WS does not expect the rate of non-target take to substantially increase above current program levels. Any non-target take is expected to be minimal (less than 50 individuals/per mammal species/year, less than 10 birds per year – all species combined) and should have no adverse effect on statewide populations.

WS has concluded that Missouri WS aquatic rodent damage management program would have no adverse effects on any native wildlife species population in Missouri. MDC concurs that Missouri WS would have no adverse effects on native wildlife populations in Missouri, including state listed T&E species (Personal consultation, Dave Hamilton, MDC).

As discussed in Section 1.5, removal of aquatic rodents may have beneficial impacts on some plant and animal species. Removal of beaver, nutria, and muskrats may reduce gnawing and feeding on certain native plant and mussel species. This alternative would have the greatest likelihood of reducing such damage since all available methods could be used or recommended. This Alternative may also result in a slight reduction in beaver created impoundments. The extent and nature of impacts would depend upon size of beaver created impoundments, whether the impoundment had been in place long enough for wetland plant and animal community to develop, and the diversity of plant and animal species in surrounding areas. Most beaver impoundments that are drained as a result of WS actions have only been in place for a short period of time and the beaver removal

returns the site to previous conditions. Positive and negative impacts of aquatic rodents are discussed in section 1.4 and 1.5, respectively.

WS has obtained and reviewed the list of T&E species for Missouri. WS consulted with the USFWS concerning potential impacts of WS methods on T&E species in Missouri. The USFWS concurred that Missouri WS aquatic rodent damage management methods "are not likely to adversely affect threatened or endangered species" in Missouri with the exception of Zinc Phosphide (ZP) (USFWS, letter to T. Stewart, 6 April 2004). Missouri WS has addressed USFWS concerns regarding ZP under section 3.6.1 Mitigation and SOPs. Specifically, WS will abide by the USFWS recommendation that WS will not use ZP in areas where listed aquatic species (mussels and fish) are known to occur. Therefore WS use of ZP will have no effect on any T&E species or critical habitat. If in the future it is determined necessary to use ZP where listed aquatic species (fish and mussels) are know to occur, WS will initiate consultation with the USFWS at that time.

Effects on public and pet health and safety - The Missouri WS program has had no accidents involving the use of firearms, traps, snares, or explosives in which any person was harmed. A formal risk assessment of WS's operational management methods found that risks to human safety were low (USDA 1997 Revised, Appendix P). Therefore, no adverse affects on human safety from WS's use of these methods is expected. Mitigation measures designed and implemented to avoid adverse effects on public and pet health and safety are described in Chapter 3.

WS may occasionally use binary explosives to breach or remove beaver dams. WS personnel responsible for use of explosives are required to complete in-depth training and must demonstrate competence and safety with use of explosives. Employees adhere to WS policies as well as regulations from the Bureau of Alcohol, Tobacco, and Firearms, the Occupational Safety and Health Administration, and the U.S. Department of Transportation with regards to explosives use, storage, safety, and transportation. WS uses binary explosives which require the mixing of two components before the explosive can be detonated. Use of binary explosives reduces the hazard of accidental detonation during storage and transportation. Storage and transportation of mixed binary explosives is not allowed. When explosives are being used by WS, warning signs are posted to restrict public entry. When beaver dams are near roads or highways, police or other road officials are used to help stop traffic and restrict public entry. MODOT crews would assist with traffic concerns to ensure public safety when WS removes beaver dams with explosives. Therefore, no adverse effects to public safety are expected from the use of explosives by WS under any alternative.

Shooting and trapping are methods used by WS which pose minimal or no threat to pets and/or public health and safety. All firearm safety precautions are followed by WS when conducting ARDM and WS complies with all laws and regulations governing the lawful use of firearms. Shooting with shotguns, pistols, or rifles is sometimes used to reduce beaver, nutria, and muskrat damage when lethal methods are determined to be appropriate. Shooting is selective for target species and may be used in conjunction with spotlights. WS uses firearms to humanely euthanize beavers, nutria, and muskrats caught in live traps. WS traps are strategically placed to minimize exposure to the public and

pets. Appropriate signs are posted on all properties where traps are set to alert the public of trap presence. Body-grip (e.g., Conibear-type) traps used for beaver and nutria are restricted to water sets which further reduce threats to public and pet health and safety.

Firearms and firearm misuse are a cause of concern because of issues relating to public safety and accidental injury or death. To ensure safe use of firearms, WS employees who use firearms to conduct official duties are required to attend an approved firearms safety and use training program within 3 months of their appointment and a refresher course every 2 years afterwards (WS Directive 2.615). WS employees who use firearms as a condition of employment must comply with all applicable Federal State and local regulations including the *Lautenberg Amendment* which prohibits firearm possession by anyone who has been convicted of a misdemeanor crime of domestic violence.

All chemicals used by APHIS/WS are regulated by the EPA through the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) and by WS Directives. Based on a thorough Risk Assessment, APHIS concluded that when WS program chemicals are used according to label directions and program Directives, they pose only a very minor risk to the health and safety of humans and pets (USDA 1997 Revised).

This Alternative would allow WS to use or recommend all available and effective damage reduction strategies and methods to reduce threats to public health and safety caused by beaver, nutria, and muskrats and beaver created impoundments. Access to the full range of ARDM methods results in the greatest possibility of alleviating risks to human health and safety from flooding, damage to roads, railroad beds and water management structures, Giardiasis outbreaks, and possible outbreaks of mosquito borne illnesses.

Humaneness of methods to be used – Under this Alternative, beaver, nutria, and muskrats could be trapped or shot by experienced WS personnel using the best method available. Issues related to the humaneness of methods available to WS under this alternative are discussed in Section 2.2.4. WS personnel are experienced and professional in use of management methods, and methods are applied humanely. As discussed in Section 3.5.5, beaver, nutria, and muskrat live-captured in traps or snares would be euthanized by shooting and are not relocated. Some aquatic rodents may be removed through the use of drowning trap sets and the use of registered toxicants. As with Alternative 2, use of lethal ARDM techniques will be perceived as inhumane by individuals opposed to actions that result in the death of the problem animal, especially advocates of animal rights. Alternative 3 may be perceived as more humane than Alternatives 1, 2, by individuals who are concerned about animal welfare, but not necessarily opposed to the use of lethal management techniques if needed because it allows WS to use non-lethal management techniques where appropriate. They may also see it as more humane than Alternatives 1, 4 and 5 because lethal management techniques would be used by trained professionals who will use these methods as humanely as possible.

Effects on wetlands – Under this alternative Beaver dams could be breached or removed by hand or with explosives for the purpose of returning streams, channels, dikes, culverts, and irrigation canals to their original drainage pattern. Beaver dams are removed according to Section 404 of the Clean Water Act (CWA). WS breaches/removes most beaver dams because of flooding in areas such as yards, parks, roads, railroads, timberlands, croplands, pastures, and other types of property or resources that were not previously flooded. Recently flooded sites do not possess wetland characteristics, and wildlife habitat values are not the same as established wetlands (Appendix C). Dam removal in these situations will be restoring the status quo for these sites and will likely be beneficial to most resident plants and animals. In the relatively rare instances when WS removes dams from an areas where wetland communities have developed, WS uses the procedures described in Appendix C describes to assure compliance with pertinent laws and regulations. For these reasons WS beaver dam removal/breaching activities should have minimal impact on wetlands.

Economic losses to property

As stated in Section (3.2.1) this alternative is anticipated to be the most effective because it allows WS to select non-lethal and lethal damage management techniques when developing site-specific damage management plans. Property damage would be expected to decrease under this Alternative since all available damage management methods and strategies would be available for WS use and consideration.

Impacts to stakeholders, including aesthetics

Impacts of this Alternative to stakeholders would be variable depending on individual values regarding wildlife. This Alternative would likely be favored by most resource owners who are receiving damage, because it allows for an IWDM approach to resolving damage problems. Most stakeholders without damage and individuals concerned about animal welfare also would prefer this Alternative to Alternative 2, because non-lethal methods could be implemented when appropriate to resolve damage problems. Some individuals will oppose this alternative because of a strong moral belief that killing or using animals for any reason is wrong. Some individuals will believe that the benefits from beaver, nutria, and muskrats would outweigh the associated damage and that resource managers should learn to live with the damage.

Possibilities of viewing and aesthetically enjoying beaver, nutria, and muskrat at a particular site could be limited if these animals are removed. However, new animals would most likely re-colonize the site in the future. Length of time until new beaver, nutria, and muskrat arrive is variable, and depends on habitat type and quality, time of year, and population densities of beaver, nutria, and muskrat in surrounding areas. In our experience in Missouri, most areas are re-colonized by beaver in 3-12 months. Opportunities to view beaver, nutria, and muskrat are available if efforts are made to visit sites with adequate habitat outside of the damage management area.

4.2.4 Alternative 4. Technical Assistance Only

Effects on beaver, nutria, and muskrat populations

WS would have no direct impact on beaver, nutria, and muskrat populations in Missouri. Impacts to beaver, nutria, and muskrat would be variable depending upon actions taken by affected landowners/resource managers. WS would provide technical advice to those persons requesting assistance. Landowners/resource managers could use information provided by WS or implement their own damage reduction program without WS technical assistance. Use of WS technical assistance may decrease the risks associated with uniformed use of lethal management techniques and may increase the use of non-lethal alternatives over that expected under Alternative 1. Overall impacts on target species populations would be similar to or slightly lower than Alternative 1 depending upon the extent to which resource managers use the technical assistance provide by WS.

Effects on plants and other wildlife species, including T&E species

When WS technical advice is requested and followed, negative impacts to plants and wildlife species resulting from the improper use of control methods should be less than Alternative 1. However, landowners/resource managers could implement their own damage reduction program without WS technical assistance.

Impacts from beaver dam breaching and removal activities would be similar to Alternative 1.

Aquatic rodent damage to native plant species may increase under this alternative unless affected resource owners implement their own aquatic rodent damage management plan.

Effects on public and pet health and safety

WS would provide technical advice to those persons requesting assistance. Negative impacts to public and pet safety resulting from the improper use of control methods should be less than Alternative 1 when WS technical advice is followed. Landowners/resource managers could use information provided by WS or implement damage reduction methods without WS technical assistance.

Impacts to public and pet safety resulting from the reduction of aquatic rodent damage and conflicts would be similar to Alternative 1.

Humaneness of methods to be used

Individuals concerned about government involvement in actions they consider inhumane would find this alternative more acceptable than Alternatives 2 and 3, and possibly Alternatives 5 depending upon individual perceptions of non-lethal ARDM techniques. Some individuals may be uncomfortable with WS providing information on the use of lethal damage management techniques. The overall humaneness of the alternative is not likely to be substantially different than Alternatives 2 and 3 because landowners/resource

managers could use lethal and non-lethal methods to reduce beaver, nutria, and muskrat damage in the absence of WS. Impacts on humaneness would depend on the experience of the person implementing the control method. Use of capture devices by inexperienced personnel may lead to increased pain and suffering by target and non-target animals. However, impacts associated with inexperienced and misinformed use of damage management techniques may be less than Alternative 1 if WS technical advice is requested and used. Some landowners/resource managers may take illegal action against localized populations of beaver, nutria, or muskrats out of frustration with continued damage. Illegal actions may be less humane than methods used by experienced WS personnel.

Effects on wetlands

WS would have no direct impact on wetlands. WS would provide technical advice to those persons requesting assistance. Resource owners could use the information provided by WS or implement their own damage reduction program without WS technical assistance. Overall impacts should be less than Alternative 1 when WS technical advice is requested and followed.

Economic losses to property

WS would provide technical advice to those persons requesting assistance to reduce economic losses. Landowners/resource managers could use information provided by WS or implement a damage reduction program without WS technical assistance. Overall impacts would be similar to or slightly better than Alternative 1 depending upon whether or not the resource manager uses WS technical assistance.

Impacts to stakeholders, including aesthetics

WS would provide technical advice to those persons requesting assistance. Resource/property owners could use information provided by WS or implement a damage reduction program without WS technical assistance. Overall impacts would be similar to Alternative 1.

4.2.5 Alternative 5. Non-lethal Beaver, Nutria, and Muskrat Damage Management

Effects on beaver, nutria, and muskrat populations

No beaver, nutria, or muskrats would be killed by WS under this Alternative. Landowners/ resource managers will have readily available access to advice/assistance with non-lethal damage management techniques. Use of non-lethal methods (e.g., water control devices or removal of dams) by WS would have little or no direct effect on beaver, nutria, or muskrat populations. However, if WSs recommendations and use of non-lethal methods are effective in reducing damage, fewer beaver, nutria, and muskrats are likely to be lethally removed by resource owners/managers than under Alternatives 1 and 2. In these instances, overall impacts on target species populations will be similar to

Alternative 3 wherein WS would use non-lethal techniques whenever practical and appropriate. In situations where damage is not reduced to acceptable levels by non-lethal methods, the impact on target species populations will depend upon the actions taken by resource owners/managers and are likely to be similar to Alternative 1.

Effects on plants and other wildlife species, including T&E species

WS lethal take of other wildlife species would not occur under this alternative. However, in those situations where non-lethal methods are not effective in reducing the damage problem, landowners/resource managers may attempt to trap and shoot beaver, nutria, and muskrat or contract private trappers with variable levels of experience resulting in risks to non-target species including T&E species similar to those described for Alternative 1. Impacts of WS use of non-lethal methods on T&E species would be similar to Alternative 3. Impacts of WS beaver dam removal and breaching activities would be similar to Alternative 3.

In situations where non-lethal methods do not effectively reduce aquatic rodent damage to plant and wildlife species impacts would be similar to Alternative 1.

Effects on public and pet health and safety

Non-lethal methods, including exclusion and habitat modifications, would not be efficient or effective in resolving many beaver, nutria, and muskrat damage situations. In situations where WS non-lethal methods and recommendations are ineffective at reducing damage to acceptable levels, impacts would be similar to Alternative 1. In situations where non-lethal methods are effective, impacts would be similar to Alternative 3.

Potential risks to public and pet safety from the use of non-lethal capture methods by WS including the removal of dams would be the same as Alternative 3. There would be no risk from WS use lethal damage management techniques because WS would not have access to these methods. However, in those situations where non-lethal methods do not reduce damage to acceptable levels, non-WS personnel may implement their own control program resulting in risks and impacts similar to Alternative 1.

Humaneness of methods to be used

Under this Alternative, only non-lethal beaver, nutria, and muskrat damage management methods would be implemented by WS. Some individuals may perceive this approach as humane because animals would not be taken lethally by WS. However, when non-lethal methods are ineffective at reducing damage to acceptable levels, resource/property owners may implement a lethal damage management program or take illegal action against some local populations of beaver, nutria, or muskrats resulting in impacts similar to Alternative 1. WS would not provide technical assistance with the use of lethal damage management techniques so the impacts associated with inexperienced or poorly informed use of lethal damage management techniques will be similar to Alternative 1.

Effects on wetlands

Beaver created impoundments could be breached/removed by hand, with machinery, or with explosives by WS for the purpose of returning streams, channels, ditches, and irrigation canals to the original drainage under this alternative. Overall impacts would be similar to Alternative 3.

Economic losses to property

Damage to property would be expected to increase when non-lethal methods are ineffective unless the landowner/resource manager seeks to implement lethal damage management techniques without WS assistance. Depending upon the level of experience and methods available to non-WS personnel conducting the damage management, the ARDM program may be less efficient and effective than a WS program thereby increasing costs to the resource manager.

Impacts to stakeholders, including aesthetics

While WS would provide non-lethal assistance under this Alternative, other individuals or entities could conduct lethal damage management. Impacts of this Alternative to stakeholders would be variable depending on effectiveness of WS non-lethal methods and resource manager/landowner actions. This Alternative would not be favored by most resource managers/landowners who are receiving damage when non-lethal methods do not reduce damage. Most stakeholders without damage would prefer this Alternative to Alternative 2, because it could make it easier for resource managers to receive help with non-lethal methods than lethal methods. Some individuals would likely support this Alternative because of a strong moral belief that killing or using animals for any reason is wrong. If resource managers/landowners do not accept WS non-lethal control methods and implement another type of control program, impacts would be similar to Alternative 1.

In situations where non-lethal methods are effective, there should be little to no impact on wildlife viewing opportunities. If non-lethal methods are not effective and the resource manager chooses to use lethal damage management techniques without WS assistance, the impacts are likely to be similar to Alternative 1.

4.3 CUMULATIVE IMPACTS

Cumulative impacts, as defined by CEQ (40 CFR 1508.7), are impacts to the environment that result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts may result from individually minor, but collectively significant, actions taking place over time.

Under Alternatives 2, 3, 4 and 5, WS would address damage associated with aquatic rodents in a number of situations throughout the State. The WS ARDM program would be the primary federal program with ARDM responsibilities; however, some state and local government agencies may conduct ARDM activities in Missouri as well. Through ongoing coordination with these agencies, WS is aware of such ARDM activities and may provide technical assistance in such efforts. WS does not normally conduct direct damage management activities concurrently with such agencies in the same area, but may conduct ARDM activities at adjacent sites within the same time frame. In addition, commercial pest control companies may conduct ARDM activities in the same area. The potential cumulative impacts analyzed below could occur either as a result of WS ARDM program activities over time, or as a result of the aggregate effects of those activities combined with the activities of other agencies and individuals.

4.3.1 Cumulative Impacts on Wildlife Populations

Aquatic rodent damage management methods used or recommended by the WS program in Missouri will likely have no cumulative adverse effects on target and non-target wildlife populations. As analyzed above, WS limited lethal take of target aquatic rodent species is anticipated to have minimal impacts on target populations in Missouri. WS works with the MDC and the USFWS to determine that aquatic rodent removals conduced by WS in combination with all other known aquatic rodent removals, including sport harvest, are not aversely impacting wildlife populations.

4.3.2 Cumulative Impact Potential from Chemical Components

Aquatic rodent damage management programs which include the use of pesticides as a lethal population management component may have the greatest potential for cumulative impacts on the environment as such impacts related to deposit of chemical residues in the physical environment and environmental toxic sis. The toxicant Zinc Phosphide is the only lethal chemical used or recommended by the Missouri WS ARDM program for the purpose of obtaining lethal effects on nutria and muskrats. This chemical has been evaluated for possible residual effects which might occur from buildup of the chemicals in soil, water, or other environmental sites. Based on use patterns, the chemical and physical characteristics of Zinc Phosphide, and factors related to the environmental fate of this pesticide, no cumulative impacts are expected from Zinc Phosphide used or recommended by the WS ARDM program in Missouri.

4.3.3 Cumulative Impact Potential from Non-chemical Components

Non-chemical methods used or recommended by WS IWDM program may include exclusion through use of various barriers, habitat modification, live trapping and euthanasia, trapping, snaring, and shooting. No cumulative impacts from WS use of these methods to take animals are expected, since take would be authorized and/or permitted with MDC oversight.

4.4 SUMMARY

Table 4.2 presents a summary of relative comparisons of the anticipated impacts of each of the alternatives as they relate to each of the major issues identified in Chapter 2.

No significant cumulative environmental impacts are expected from any of the listed Alternatives (Table 4.3). With regard to Alternatives 2 and 3, Lethal Removal Only and the Proposed Action, respectively, lethal removal of beaver, nutria, and muskrats by WS would have no adverse affect on beaver, nutria, or muskrat populations in Missouri. No adverse risk to public or pet health and safety is expected from control methods implemented by WS under Alternatives 2, 3, and 5. However, some persons would likely oppose lethal removal of beaver, nutria, and muskrats under any circumstance. Analyses in this EA indicate that such removals would result in no significant cumulative adverse impacts on the quality of the human environment.

Table 4.3. Summary of cumulative environmental impacts and Alternatives presented for ARDM conducted in Missouri.

	Alternative 1: *No WS Beaver, Nutria, or Muskrat Damage Management*	**Alternative 2**: *Only Lethal Beaver, Nutria, or Muskrat Damage Management by WS*	**Alternative 3**: *Integrated Beaver, Nutria, and Muskrat Damage Management by WS (No Action/ Proposed Action)*	**Alternative 4**: *WS only Provides Technical Assistance*	**Alternative 5** *Only Non-leth Beaver, Nutria, Muskrat Dama Management b WS*
Effects on Beaver, Nutria, and Muskrat Populations	No effects by WS. Impact on population will depend on actions of resource managers.	Possible reduction in local populations, no statewide effect.	Possible reduction in local populations, no statewide effect.	No effects by WS. Impacts on populations will depend on actions of resource managers	No effects by W Impacts on populations will depend on actio by resource managers
Effects on plants and other wildlife species, including T&E Species	No effects by WS. Impacts by non-WS personnel would be variable.	Very low impacts on plant and wildlife species, including T&E species populations.	Very low impact to plant and wildlife species, including T&E species populations.	No effects by WS. Impacts by non-WS personnel would be variable.	Low impacts to plant and wildli species, includi T&E species by WS. Impacts b non-WS person would be variab
Effects on Public and Pet Health and Safety	No effects by WS. Risks variable depending upon actions taken by resource managers.	No threat to public and pet safety from WS actions. Reduction of risks from flooding, burrowing, and diseases.	No threat to public and pet safety from WS control methods. Greatest reduction of risks from flooding, burrowing, and diseases.	No effects by WS. Risks variable depending upon actions taken by resource managers	No threat to pub and pet safety fr WS control methods. Some reduction of risk from flooding, burrowing, and diseases. Some risks variable depending upon actions of non-V personnel
Humaneness of Methods to be Used	No effect by WS. Impacts by non-WS personnel would be variable because managers could still use lethal and non-lethal.	WS personnel are trained in humane use of lethal methods. Some people would oppose all lethal methods. Resource managers could still implement non-lethal.	WS uses the most humane methods available. Some activists would oppose all lethal methods. May be preferable to Alt. 2 because WS would use non-lethal.	No effect by WS. Impacts by non-WS personnel would be variable. Mangers could still use lethal and non-lethal.	WS actions wou probably be considered mor humane than Al 2 and 3. Manag can still use leth techniques.
Effects on Wetlands	No effect by WS. Impacts	Minor effect by WS because of	Extremely low impacts because	No effect by WS. Impacts by	Extremely low impacts because

	by managers depends on methods selected	beaver removal. Impacts by managers depends on methods selected	most sites are not established wetlands	managers depends on methods selected	most sites are n established wetlands
Economic Losses to Property	Losses would likely increase unless action taken without WS.	Losses could be reduced or eliminated by WS unless non-lethal more appropriate.	Highest likelihood that losses would be reduced or eliminated by WS.	Losses could be reduced or eliminated if resource owners take action. Success more likely if WS information is used.	Losses could be reduced by WS not as much or a likely as with A 2 and 3. Manag may be able to g further reductio they use lethal techniques.
Impacts to Stakeholders, including Aesthetics	No effects by WS. Variable, some people prefer this method. People receiving damage probably oppose this alternative. Managers could still use lethal and non-lethal without WS.	Variable, those receiving damage would probably favor this alternative if damage could be reduced by lethal methods. Some people will oppose WS' use of lethal, but managers can still use lethal without WS.	Variable, those receiving damage would probably favor this alternative. Some people will oppose WS' use of lethal, but managers can still use lethal without WS.	No effects by WS. Variable, some people prefer this method. People receiving damage probably oppose this alternative. Managers could still use lethal and non-lethal without WS.	Variable, those receiving damag would probably favor this alternative if damage could b reduced by non-lethal methods. Some people would favor this alternative beca no WS use of lethal. Manage could still use lethal without W

APPENDIX A

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APPENDIX B

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APPENDIX C

CRITERIA FOR BEAVER DAM BREACHING/REMOVAL

Beaver dam breaching/removal is generally conducted to maintain existing stream channels and drainage patterns and/or to reduce flood waters. Beaver dams are usually made from natural debris such as logs, sticks, and mud. However, beaver are opportunistic when it come to materials for dam construction and dams may contain man-made materials such as tires, plastic pipe, or plywood. When beaver dams are breached, the material is removed from the approximate center of the dam or the area closest to the existing channel. The dams that WS removes are normally the result of recent beaver activity and the resulting ponds have not been in place long enough to generate characteristics of a true wetland (i.e., hydric soils, hydrophytic vegetation, and hydrology). Beaver dam breaching/removal by hand or with binary explosives does not affect the substrate or the natural course of the stream and returns the area back to its preexisting condition with similar flows and circulations. Because beaver dams involve waters of the United States, dam breaching/removal is regulated under Section 404 of the CWA.

Wetlands are recognized by three characteristics: hydric soils, hydrophytic vegetation, and general hydrology. Hydric soils are either composed of, or have a thick surface layer of, decomposed plant materials (muck); sandy soils have dark stains or streaks from organic material in the upper layer where plant material has attached to soil particles. Hydric soils may be bluish gray or gray below the surface or brownish black to black and commonly smell of rotten eggs. Wetlands also have hydrophytic vegetation present such as cattails, bulrushes, willows (*Salix* sp.), sedges (*Carex* sp.), and water plantains (*Alismataceae*). A final indicator is general hydrology which includes standing and flowing water or waterlogged soils during the growing season; high water marks often are present on trees and drift lines of small piles of debris are usually present. Beaver dams usually will develop a layer of organic material at the surface. Silt deposits can occur rapidly, but aquatic vegetation and high water marks (a new high water mark is created by the beaver dam) are usually not present. However, cattails and willows can show up rapidly if they are in the vicinity, but most hydrophytic vegetation takes time to establish.

In most beaver dam breaching/removal operations, the material that is displaced is exempt from permitting or included in a Nationwide Permit (NWP) in accordance with Section 404 of the CWA (33 CFR Part 323). A permit would be required if the impoundment caused by a beaver dam was not covered under a NWP or permitting exemption and was a true wetland. WS biologists and specialists survey the beaver dam site and impoundment to determine if conditions exist for classifying the site as a true wetland. If wetland conditions exist, the landowner or cooperator is asked the approximate age of the dam or how long he/she has known of its presence. This information is useful in determining if Swampbuster, Section 404 permit exemptions, or nationwide permits will allow breaching/removal of the beaver dam. If it is determined that a dam cannot be removed or breached under provisions provided by Swampbusters, 404 permit exemption or NWP, the landowner or cooperator is responsible for obtaining a Section 404 permit before the dam could be breached/removed by WS.
The following explains Section 404 exemptions and conditions that pertain to the breaching/removal of beaver dams.

33 CFR 323 - Permits For Discharges of Dredged or Fill Material into Waters of the United States. This regulation provides guidance to determine whether certain activities require permits under Section 404.

Part 323.4 Discharges not requiring permits. This section establishes exemptions for discharging certain types of fill into waters of the United States without a permit. Certain minor drainage activities connected with normal farming, ranching, and silvicultural practices do not require a permit as long as these drainages do not include the immediate or gradual conversion of a wetland (i.e., beaver ponds greater than 3 years old) to a non-wetland. Specifically, part (a)(1)(iii)(C)(i) states, "*...fill material incidental to connecting upland drainage facilities* (e.g., drainage ditches) *to waters of the United States, adequate to effect the removal of excess soil moisture from upland croplands...*". This indicates that beaver dams that block ditches, canals, or other structures designed to drain water from upland crop fields can be breached without a permit.

Moreover, (a)(1)(iii)(C)(iv) states the following types of activities do not require a permit. "*The discharges of dredged or fill materials incidental to the emergency removal of sandbars, gravel bars, or other similar blockages which are formed during flood flows or other events, where such blockages close or constrict previously existing drainage ways and, if not promptly removed, would result in damage to or loss of existing crops or would impair or prevent the plowing, seeding, harvesting or cultivating of crops on land in established use for crop production. Such removal does not include enlarging or extending the dimensions of, or changing the bottom elevations of, the affected drainage way as it existed prior to the formation of the blockage. Removal must be accomplished within one year of discovery of such blockages in order to be eligible for exemption.*" This allows the breaching of beaver dams in natural streams to restore drainage of agricultural lands within one year of discovery.

Part 323.4 (a)(2) allows "*Maintenance, including emergency reconstruction of recently damaged parts, of currently serviceable structures such as dikes, dams, levees, groins, riprap, breakwaters, causeways, bridge abutments or approaches, and transportation structures. Maintenance does not include any modification that changes the character, scope, or size of the original fill design. Emergency reconstruction must occur within a reasonable period of time after damage occurs in order to qualify for this exemption.*" This allows beaver dams to be breached without a permit where they have resulted in damage to roads, culverts, bridges, or levees if it is done in a reasonable amount of time.

33 CFR 330 – Nationwide Permit (NWP) Program

The USACE, Chief of Engineers is authorized to grant certain dredge and fill activities on a nationwide basis if they have minimal impact on the environment. NWP are listed in Appendix A of 33 CFR 330 and those permitted must satisfy all terms and conditions established to qualify for their use. Individual beaver dam breaching by WS may be covered by any of the following NWP if not already exempted from permit requirements by the regulations discussed above. WS

complies with all conditions and restrictions placed on NWP for any instance of beaver dam breaching/removal done under a specific NWP.

Nationwide permits can be used **except** in any component of the National Wild and Scenic River System such as waterways listed as an "*Outstanding Water Resource*", or any water body which is part of an area designated for *"Recreational or Ecological Significance"*.

> ***NWP 3*** authorizes the rehabilitation of those structures, such as culverts, homes, and bridges, destroyed by floods and "discrete events," such as beaver dams, provided that the activity is commenced within 2 years of the date when the beaver dam was established.
>
> ***NWP 18*** allows minor discharges of dredged and fill material, including the breaching of beaver dams, into all waters of the United States provided that the quantity of discharge and the volume of excavated area does not exceed 10 cubic yards below the plane of the ordinary high water mark (this is normally well below the level of the beaver dam) or is in a "special aquatic site" (wetlands, mudflats, vegetated shallows, riffle and pool complexes, sanctuaries, and refuges). The District Engineer must be "notified" (general conditions for notification apply), if the discharge is between 10-25 cubic yards for a single project or the project is in a special aquatic site and less than $^{1}/_{10}$ of an acre is expected to be lost. If the values are greater than those given, a permit is required. Beaver dams rarely would exceed 2 or 3 cubic yards of backfill into the waters and probably no more than 5 cubic yards would ever be exceeded. Therefore, this stipulation is not restrictive. Beaver dams periodically may be breached in a special aquatic area, but normally the aquatic site will be returned to normal. However, if a true wetland exists, and beaver dam breaching/removal is not allowed under another permit, then a permit must be obtained from the District Engineer.
>
> ***NWP 27*** provides for the discharge of dredge and fill for activities associated with the restoration of wetland and riparian areas with certain restrictions. On non-federal public and private lands, the owner must have: a binding agreement with USFWS or NRCS to conduct restoration; a voluntary wetland restoration project documented by NRCS; or notify the District Engineer according to "notification" procedures. On federal lands, including USACE and USFWS, wetland restoration can take place without any contract or notification. This NWP "*...applies to restoration projects that serve the purpose of restoring "natural" wetland hydrology, vegetation, and function to altered and degraded non-tidal wetlands and "natural" functions of riparian areas. This NWP does not authorize the conversion of natural wetlands to another aquatic use...*" If operating under this permit, the breaching/removal of a beaver dam would be allowed as long as it was not a true wetland. Non-federal public and private lands require the appropriate agreement, project documentation, or notification to be in place.

A quick response without delays resulting from permitting requirements can be critical to the success of minimizing or preventing aquatic rodent damage. Damage often escalates the longer an area remains flooded. Exemptions contained in the above regulations or NWP provide for the breaching/removal of the majority of beaver dams that Missouri WS encounters. The primary

determination that must be made by WS personnel is whether a beaver impounded area meets the criteria to be classified as a true wetland or is the area a more recently flooded site lacking true wetland characteristics. Flexibility allowed by these exemptions and NWP is important for the efficient and effective resolution of many beaver damage problems.

APPENDIX D

METHODS USED OR RECOMMENDED BY MISSOURI WS FOR BEAVER, NUTRIA, AND MUSKRAT DAMAGE MANAGEMENT

Resource owners and government agencies have used a variety of techniques to reduce beaver, nutria, and muskrat damage. However, all lethal and non-lethal methods developed to date have limitations based on costs, logistics, and effectiveness. Below is a discussion of beaver, nutria, and muskrat damage management methods currently available to the Missouri WS program. If additional data or new products become available in the future, WS could consider these techniques among methods to be used. Any additional NEPA analysis deemed necessary will be conducted prior to incorporating the technique into the program.

NON-LETHAL DAMAGE MANAGEMENT METHODS

Habitat Management

Habitat management for the reduction of beaver, nutria, and muskrat damage refers to manipulation of vegetation or the physical characteristics of the site to reduce the attractiveness of the site to beaver, nutria, and muskrats. Habitat management may offer long-term solutions for addressing aquatic rodent damage. Unfortunately, use of habitat management is limited by the fact that alterations which make a site unsuitable for problem aquatic rodents often make the site unsuitable for many desirable wildlife species. WS may recommend habitat management practices, but the work is usually conducted by the resource manager.

Beaver.

Habitat alteration may be the most effective long-term method of reducing beaver density in some areas (Payne 1989). Forest management practices that discourage the establishment of willow (*Salix sp.*), sweet gum (*Liquidambar styraciflua*), and conifers and promote long-lived hardwoods within 200 - 400 feet of streams may reduce beaver populations on those streams. Payne (1989) suggested that reduced food availability might force beaver colonies to move more often. However, this increased movement could increase nuisance complaints.

Continual breaching of dams and removal of dam construction materials on a daily basis sometimes will cause beaver to move to other locations. The Beaver Deceiver is a water control system that attempts to quiet, calm, and deepen the water in front of culverts (to reduce the attractiveness to beaver) and exclude beaver from a wide area around the upstream opening of the culvert (Lisle 1996). However, effectiveness of this method has not been evaluated in published documents.

Nutria.

Land that is well drained and free of dense, weedy vegetation is generally unattractive to nutria. Use of "good farming practices", such as precision land leveling and weed management, can minimize nutria damage in agriculture areas. Any drainage that holds water can be used by nutria as a travel route or home site. Small, contour ditches can help to eliminate low spots and enhance rapid drainage on poorly drained soils.

Grading and bulldozing can destroy active burrows in the banks of steep sided ditches and waterways. In addition, contour bank slopes less than 45° can discourage new burrowing. Eliminating brush, trees, thickets, and weeds from fence lines and turn rows that are adjacent to ditches, drainages, waterways and other wetlands often discourage nutria activities. Burning or removing cleared vegetation from the site also discourages nutria activities. Brush piles left on the ground or in low spots can become ideal summer homes for nutria.

Muskrat.

One of the best ways to reduce habitat for muskrats is to eliminate aquatic or other suitable foods preferred by muskrats. Habitat alterations to reduce cattail wetlands could reduce the density of muskrats. Where possible, constructing pond dams in a manner that discourage burrowing also will help protect resources. Preventing muskrats from burrowing into dams can be achieved by drawing water levels down in winter and filling burrows with rip-rap.

Water Management

Water management practices are those techniques intended to eliminate or minimize impacts associated with the ponds that result from beaver dams. These types of devices may be installed by WS or by the resource manager.

Water Control Devices

Pond levelers and water control devices have been used in many different states with varying degrees of success. These devices work by lowering the level of water within the pond. The primary advantage of these devices is that they can be used to increase resource manager tolerance of beaver by reducing the amount of land affected by the beaver pond but still allow for some of the wildlife benefits associated with beaver ponds.

Various types of water control devices have been described (Arner 1964, Roblee 1984, Laramie and Knowles 1985, Lisle 1996). Water control devices generally are of two designs. One design is a perforated pipe passing through the beaver dam (Roblee 1983, Roblee 1984, Laramie and Knowles 1985, Roblee 1987, Miller and Yarrow 1994, Lisle 1996, Nolte et al. 2000), and the second design is a fence erected 15 - 90 feet in front of the culvert to prevent the beaver from blocking the culvert with debris (Lisle 1996). Erection of a fence could be considered exclusion, but when used in conjunction with a

pipe or culvert, is considered a water control device. The second design may have a perforated pipe going from the fence to the culvert to allow water to flow, because the fence may become clogged with debris.

Clemson beaver pond levelers are one of the water control devices consisting of a perforated pipe that passes through the beaver dam. Clemson pond levelers have proven effective in reducing flooding in certain situations if properly maintained (Miller and Yarrow 1994, Minnesota Department of Natural Resources 1994). Nolte et al. (2000) found that 50% of resource managers in Mississippi with Clemson pond levelers rated them as effective in meeting management objectives. Resource manager objectives were a major factor in determining satisfaction with the levelers. Managers who wished to control or eliminate flooding were less satisfied with the levelers than managers who wished to manage some wetlands for wildlife and still meet other land management goals. The devices were more effective if they received post-installation maintenance. Levelers placed in areas with high beaver activity frequently failed if beaver population control measures (e.g., beaver removal) were not implemented.

Use of pond levelers or water control devices may require frequent maintenance depending on type of water control device. Continued maintenance is often necessary for the device to remain operational because stream flow, leaf fall, floods, and continued beaver activity will continuously bring debris to the water control device. Maintenance of water control devices can be expensive. Annual costs are often also associated with suppressing or eradicating local beaver populations to keep the devices operational (Nolte et al. 2001).

Cost of water control devices is variable depending on number of devices/dam, type of device, materials, and labor. Large dams may need multiple devices to accommodate the volume of water in the flowage. Materials and installation of water control devices can be relatively modest for a three-log drain (Arner 1964), $500 - $750 for a single modified Clemson beaver pond leveler, $1050 - $2,300 for a single beaver stop, or over $1,000 for a Beaver Deceiver. A modified Beaver Deceiver can be constructed for $250 -$300; however, annual maintenance costs were estimated at $350 (E. Butler, USDA/APHIS/WS, personal communication).

Water control devices are most effective on wetlands lacking in-stream flow (B. Sloan, USDA/APHIS/WS, personal communication), and may be ineffective in beaver ponds in broad, low-lying areas (Organ et al. 1996). Water control devices may not be appropriate in streams or ditches with continuous flow, because the volume of water is too great for the device to handle. Streams and ditches with continuous flow often carry debris to the device and cause drainage problems. Periods of unusually high rainfall or increased water flow may render the devices less effective because of increased water volume (Wood et al. 1994, Anonymous 1999).

Beaver Dam Breaching/Removal

Dam breaching involves the removal of debris deposited by beaver that impedes the flow of water. Breaching a beaver dam is generally conducted to maintain existing streams and irrigation channels, restore drainage patterns, and reduce flood waters that have negatively impacted silvicultural, agricultural, residential or ranching/farming activities. Beaver dams removed by WS are normally from recent beaver activity, and sites have not had enough time to develop characteristics of a true wetland (i.e., hydric soils, hydrophytic vegetation, and hydrological function). Unwanted beaver dams may be removed by hand or with explosives. Explosives are used only by WS personnel specially trained and certified to conduct such activities.

Because beaver dams involve waters of the United States, removal is regulated under Section 404 of the CWA (Appendix C). Beaver dam breaching does not affect substrate or natural course of streams. Breaching beaver dams often re-establishes preexisting conditions with similar flows and circulations. Most beaver dam breaching operations, if considered discharge, are covered under 33 CFR 323 or 330 and do not require a permit. A permit would be required if the beaver dam breaching activity is not covered by a 404 permitting exemption or NWP and the area affected by the beaver dam was considered a true wetland. WS personnel survey the site or impoundment to determine if conditions exist for classifying the site as a true wetland. If the site appears to have conditions over 3 years old or appears to meet the definition of a true wetland, the landowner or cooperator is required to obtain a permit before proceeding (See Appendix C for information that explains Section 404 permit exemptions and conditions for breaching/removing beaver dams).

Explosives

Explosives are defined as any chemical mixture or device which serves as a blasting agent or detonator. Explosives are generally used to breach beaver dams that are too large to remove by hand digging and after beaver have been removed from the site. Binary explosives consist of ammonium nitrate and nitro-methane and are not classified as explosives until mixed. Therefore, binary explosives are subject to fewer regulations and controls. However, once mixed, binary explosives are considered high explosives and subject to all applicable federal regulations. Detonating cord and detonators are considered explosives and WS must adhere to all applicable State and federal regulations for storage, transportation, and handling. All WS explosive specialists are required to attend 30 hours of extensive explosive safety training and spend time with a certified explosive specialist in the field prior to obtaining certification. All blasting activities are conducted by well-trained, certified blasters and closely supervised by professional wildlife biologists. Explosive handling and use procedures follow the rules and guidelines set forth by the Institute of Makers of Explosives which is the safety arm of the commercial explosive industry in the United States and Canada. WS also adheres to transportation and storage regulations from State and federal agencies such as Occupational Safety and Health Association, Bureau of Alcohol, Tobacco, and Firearms, and the Department of Transportation.

Exclusion Methods

Exclusion involves physically preventing beaver, nutria, or muskrats from gaining access to protected resources through fencing or other barriers. Some of these devices may be installed/used by WS, but most are installed by the resource manager. Fencing of small critical areas such as around culverts and drain pipes can sometimes prevent plugging by beaver. A variety of road culvert screens or fences have been used by county and local highway departments. In most cases the screens do not completely solve the damage problem, because a workforce is still required to remove beaver dam materials from the screen or fence. The main benefit of this technique is to prevent beaver dam materials from being deposited inside the culvert. Construction of concrete spillways may reduce or prevent damage to dams. Rip-rap also can be used on dams or levees at times to deter burrowing. Electrical barriers have proven effective in limited situations for excluding mammals and birds. An electrical field through the water in a ditch or other narrow channel, or hot-wire suspended just above the water level in areas protected from public access, have been effective at excluding mammals and birds. Effectiveness of an electrical barrier is extended when used in conjunction with an odor or taste cue that is emitted, because beaver will continue to avoid the area even if the electrical field is discontinued (Kolz and Johnson 1997).

Protecting ornamental or landscape trees from beaver, nutria, and muskrat damage by using hardware cloth or similar material, or chain-link fence is recommended frequently by WS. Recent preliminary tests by NWRC suggest that sand mixed in paint may be an effective barrier against beaver gnawing and cutting of trees or other objects (D. Nolte, USDA/APHIS/WS/ National Wildlife Research Center, unpublished data). This method is used most frequently by property and homeowners. It is rarely, if ever, used to prevent large-scale timber or forest damage due to high material costs and labor required to wrap hundreds or thousands of trees in a managed forest.

Capture Methods

In some instances, removal of specific animals in the problem area can provide immediate relief from a problem. In these situations, the goal is to reduce beaver, nutria, and muskrat numbers to a level that stabilizes, reduces or eliminates damage. Level of removal necessary to achieve a reduction of damage varies according to the resource protected, habitat, population, effectiveness of other damage management strategies, and other ecological factors. Some capture devices like snares, leg-hold traps, cage traps and colony traps can be set so that the animal is restrained until the WS specialist comes to relocate or euthanize the animal. The advantage of these types of devices is that non-target species can be released. Snares and leg-hold traps can also be set so that the animal is killed. Other capture devices like Conibear traps kill the captured animal. For reasons discussed in Section (3.5.5), WS does not relocate beaver, nutria, and muskrats in Missouri, and all live-captured target animals would be euthanized.

These techniques are usually implemented by WS personnel because of technical training required to safely and effectively use such devices. A formal risk assessment of all mechanical devices used by the WS program in Missouri can be found in USDA (1997). Despite the numerous damage management methods developed, trapping remains the most effective method

of removing beaver and reducing damage (Hill 1976, Hill et al. 1977, Wigley 1981, Weaver et al. 1985).

Leg-hold traps can be effectively used to capture a variety of mammals. Leg-hold traps are either placed beside, or in some situations, within travel ways being actively used by target species. Placement of traps is contingent upon habits of the respective target species, habitat conditions, and presence of non-target animals. Trap and lure placement and trap adjustment by trained WS personnel contribute to the leg-hold trap's efficacy and selectivity. Generally all leg-hold traps used to capture aquatic rodents are set near adequate water depth and rigged with a drowning mechanism that will immediately dispatch the animal. Use of leg-hold traps requires more skill than some methods, but leg-hold traps are indispensable in resolving many damage problems. Beaver, nutria, and muskrats live-captured in leg-hold traps would be euthanized by shooting.

Snares are capture devices comprised of a cable formed in a loop with a locking device. Snares are often placed in travel ways and equipped with a swivel to minimize cable twisting and breakage. Snares are easier to set and transport and are less affected by inclement weather than leg-hold and Conibear traps. Target animals are caught around the body, neck, or leg and later euthanized by shooting. As with leg-hold traps, snares can be set so the animal is drowned immediately after capture.

Hancock traps (suitcase/basket type cage traps) are designed to live-capture beaver. This type of trap is constructed of a metal frame covered in chain-link fence that is hinged with springs. Trap appearance is similar to a large suitcase when closed. When set, the trap is opened to allow an animal to enter, and when tripped the sides close around the animal. One advantage of using the Hancock trap is the ease of release of beaver or non-target animals. Disadvantages of these traps are expense (approximately $275 per trap), cumbersome and bulky size, and difficulty to set (Miller and Yarrow 1994). Hancock traps can also be dangerous for humans to set (i.e., hardhats are recommended when setting suitcase traps), are less cost and time-efficient than snares, leg-hold, and body-grip traps, and may cause serious and debilitating injury to otters (Blundell et al. 1999). Beaver captured in Hancock traps would be euthanized by shooting.

Colony traps are multi-catch traps used to either live-capture or drown muskrats. There are various types of colony traps. One common type of colony trap consists of a cylindrical tube of wire mesh with a one-way door on each end (Novak 1987b). Colony traps are set at entrances to muskrat burrows or placed in muskrat travel lanes. Colony traps are effective and relatively inexpensive and easy to construct (Miller 1994). The stovepipe trap, a common type of colony trap, is usually made with sheet metal and may capture two to four muskrats on the first night (Miller 1994). Muskrat live captured in colony traps would be euthanized by shooting.

Body-grip (e.g., Conibear) traps are designed to cause the quick death of the animal that activates the trap. The number 330 body-grip trap is generally used for beaver, the number 220 for nutria and the number 110 for muskrat. Body-grip traps for beaver capture are used exclusively in aquatic habitats, with placement depths varying from a

few inches to several feet below the water surface. Smaller Conibear traps, such as those used for muskrats, can be set either in or out of the water. Placement is in travel ways or at lodge or burrow entrances. Animals are captured as they travel through the trap and activate the triggering mechanism. Safety hazards and risks to humans are usually related to setting, placing, checking, or removing the traps. Body-grip traps present a minor risk to non-target animals because of the selectivity of placement in aquatic habitats and below the water surface.

Shooting

Shooting is the most selective method for removing target species and may involve use of spotlights and shotguns, rifles, or pistols. Shooting is an effective method to remove small numbers of beaver, nutria, or muskrat in damage situations, especially where trapping is not feasible or appropriate for site conditions. Shooting is sometimes utilized as one of the first lethal damage management options because it offers the potential of resolving a problem more quickly and selectively than some other methods, but it does not always work. Shooting aquatic rodents may also be more labor-intensive than some other techniques. Shooting may sometimes be one of the only beaver, nutria, or muskrat damage management options available if other factors preclude setting of damage management equipment. WS personnel receive firearms safety training to use firearms that are necessary for performing damage management duties.

Firearm use is a very sensitive issue because of public concerns regarding firearm safety and misuse of firearms. WS employees who use firearms to conduct official duties are required to attend firearm safety and handling training within 3 months of their appointment and refresher training every 2 years afterwards (WS Directive 2.615). Many WS employees carry firearms as a condition of employment and are required to certify that they meet the criteria as stated in the *Lautenberg Amendment* which prohibits firearm possession by anyone who has been convicted of a misdemeanor crime of domestic violence.

CHEMICAL MANAGEMENT METHODS

All chemicals used by Missouri WS are registered under FIFRA and administered by the EPA and the Missouri Department of Agriculture. No chemicals are used on public or private lands without authorization from the land management agency or property owner/manager. The only chemical method currently authorized for use in Missouri is zinc phosphide.

Zinc phosphide is a toxicant that would be registered in Missouri for use in nutria and muskrat damage management. No toxicants are registered for use on beaver. Use of zinc phosphide on various types of fruit, vegetable, or cereal baits (e.g., apples, carrots, sweet potatoes, oats, barley) has proven to be effective at suppressing local muskrat and nutria populations. All chemicals used by WS are registered under FIFRA and administered by EPA and Missouri Department of Agriculture. Zinc phosphide is federally registered for use by APHIS/WS. Specific bait applications are designed to minimize non-target hazards (Evans 1970). Zinc phosphide presents minimal secondary hazard to predators and scavengers. Zinc phosphide is an emetic; therefore, meat-eating animals such as mink, dogs, cats, and raptors regurgitate animals that are killed with zinc phosphide with

little or no effect. WS personnel that use chemical methods are certified as pesticide applicators by Missouri Department of Agriculture and are required to adhere to all certification requirements set forth in FIFRA and the Missouri pesticide control laws and regulations. No chemicals are used on federal or private lands without authorization from the land management agency or property owner/manager. A quantitative risk assessment, which evaluated potential impacts of WS use of chemical methods when used according to the label, concluded that no adverse effects are expected from the above (USDA 1997 Revised).